Department of Energy
National Nuclear Security Administration
1301 Clay Street
Oakland, California 94612-5208

JAN 0 9 2002

Subject: *Draft* Environmental Assessment (EA) for the Cleanup and Closure of the Energy Technology Engineering Center (ETEC), Simi Valley, California.

Dear Stakeholder,

On January 9, 2002, the U.S. Department of Energy (DOE) officially released the enclosed *draft* EA for the Cleanup and Closure of ETEC, Simi Valley, California. The public comment period for the EA will be ***January 9, 2002 through February 11, 2002.*** During this time, you or your organization may submit formal comments about the EA, which will be considered by DOE in the preparation of a final EA.

DOE has prepared this *draft* EA to evaluate the potential impacts of implementing *additional* cleanup and closure activities at ETEC. Three cleanup actions are described, a preferred action and two alternative proposals. An analysis of potential impacts on human health and the environment are presented as a part of each of these three proposals.

The EA document will be available for public review at three local informational repositories:

Simi Valley Library
2969 Tapo Canyon Road
Simi Valley, CA
(805) 526-1735

California State University, Northridge
Urban Archives Center
Oviatt Library, Basement, Room 4
18111 Nordhoff Street
Northridge, CA
(818) 885-2832

Platt Branch Library
23600 Victory Boulevard
Woodland Hills, CA
(818) 340-9386

Copies of the EA document are available by:
- Contacting the **Energy Information Center at** (510) 637-1762
- Sending an **email request to** etec.ea@oak.doe.gov.
- Downloading a copy at the **DOE/OAK website,** http://www.oak.doe.gov/etec_ea.html

The EA can be referenced by its Document Release No: DOE/EA-1345.

On January 24, 2002, two public meetings will take place (2pm-4pm and 7pm-9pm) at the Grande Vista Hotel (999 Enchanted Way, Simi Valley), during which, public officials and community leaders will be available to answer questions about the EA.

Sincerely,

John L. [signature]

for James T. Davis
Assistant Manager
for Environment and
Nuclear Energy

Enclosure

DOE/EA-1345

ENVIRONMENTAL ASSESSMENT FOR CLEANUP AND CLOSURE OF THE ENERGY TECHNOLOGY ENGINEERING CENTER

DRAFT

January 2002

U.S. Department of Energy
Oakland Operations Office
Oakland, CA

DOE/EA-1345

ENVIRONMENTAL ASSESSMENT FOR CLEANUP AND CLOSURE OF THE ENERGY TECHNOLOGY ENGINEERING CENTER

DRAFT

January 2002

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ACRONYMS

ALARA	as low as reasonably achievable
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
ETEC	Energy Technology Engineering Center
LLW	low-level radioactive waste
MLLW	mixed low-level waste
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RMHF	Radioactive Materials Handling Facility
WIPP SEIS-II	*Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*
SNAP	Space Nuclear Auxiliary Power
SPTF	Sodium Pump Test Facility
SSFL	Santa Susana Field Laboratory
TCE	trichloroethylene
TRU	transuranic
WIPP	Waste Isolation Pilot Plant
U.S.C.	United States Code

GLOSSARY

Additional theoretical lifetime cancer risk

The potential risk to an individual of developing cancer that could result from that individual's exposure to radiological contaminants over and above the existing risk from exposure to naturally occurring (background) levels of radiation. The lifetime risk of incurring cancer from all causes is 0.23, according to the U.S. National Center for Health Statistics (1998).

Background radiation

Radiation from naturally occurring radioactive materials as they exist in nature (such as radon) and cosmic rays from space filtered through the Earth's atmosphere. Other sources of background radiation include medical procedures (x-rays), air travel, consumer and industrial products, and fallout from prior nuclear weapons testing. Background radiation in the United States averages 300 millirem per year.

Berm

A sloped wall or embankment (typically constructed of earth, hay bales, or timber framing) used to prevent inflow or outflow of material into/from an area.

Contamination

The deposition of unwanted radioactive or hazardous material on the surfaces of structures, areas, objects, or people.

Decommissioning

The process of removing from service a facility that is no longer needed for its original purpose. For facilities in which nuclear materials were handled, it usually involves decontaminating the facility so that it may be dismantled or dedicated to other purposes.

Decontamination

The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive contamination from facilities, soil, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

Fast breeder reactor

A nuclear reactor with fertile material loaded around the core, to be converted into fissile material through neutron capture, which generates more fissile material than is consumed.

Latent cancer fatality

A fatality resulting from a cancer that was originally induced by radiation but which may occur years after the exposure. Small doses of radiation result in fractional latent cancer fatalities, or only a probability that a latent cancer fatality may be incurred. The lower the fractional latent cancer fatality, the lower the probability that a latent cancer fatality will be incurred. For example, 1×10^{-4} latent cancer fatalities means 1 chance in 10,000 of incurring a latent cancer fatality; 1×10^{-6} latent cancer fatalities means 1 chance in 1 million of incurring a latent cancer fatality.

Maximally exposed individual

A hypothetical individual whose location and habits result in the highest possible total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (for example, inhalation, ingestion, direct exposure). For purposes of analyzing the impacts of decontamination, decommissioning, and demolition activities at ETEC, the maximally exposed individual was assumed to be an individual living off the site in a residence 2,867 meters (9,406 feet) northwest of the Radioactive Materials Handling Facility. For purposes of analyzing the risk of residual contamination on the site following remediation, the maximally exposed individual was assumed to be an individual living on the site for 40 years.

National Environmental Policy Act of 1969 (NEPA)

A federal act designed to promote inclusion of environmental concerns in federal decision-making. The Act is implemented by procedures issued by the Council on Environmental Quality and DOE.

Millirem (mrem)

One-thousandth of a rem (0.001 rem); *see* "Rem."

Rem (Roentgen Equivalent in Man)

The unit of a dose equivalent from ionizing radiation to the human body that is used to measure the amount of radiation to which a person has been exposed.

Remediation

Action taken to permanently remedy a release or threatened release of a hazardous substance to the environment, instead of or in addition to removal.

Scientific notation

A system of expressing very large or very small numbers based on the use of positive and negative powers of 10. A number written in scientific notation is expressed as the product of a number between 1 and 10 and a positive or negative power of 10.

Examples:
5,000 would be written as 5×10^{3}
0.005 would be written as 5×10^{-3}

Scoping

An early and open process for determining the range of issues to be addressed in an environmental impact statement or environmental assessment (EA) and for identifying the significant issues related to a proposed action.

Waste characterization

The identification of waste composition and properties by reviewing process knowledge, nondestructive examination, nondestructive assay, or sampling and analysis. Characterization provides the basis for determining appropriate storage, treatment, handling, transportation, and disposal requirements.

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Oakland Operations Office is responsible for the operation of the Energy Technology Engineering Center (ETEC), a government-owned complex of buildings located on approximately 364,000 square meters (90 acres) within Area IV of the Santa Susana Field Laboratory (SSFL) (*see* Figure 1-1). The 11-square-kilometer (2,850-acre) SSFL is located atop a range of hills between the Simi and San Fernando Valleys in southeastern Ventura County, California. ETEC is operated by Rocketdyne Propulsion & Power, a division of The Boeing Company. ETEC does not have specific site boundaries, but rather is a group of facilities owned by DOE or where DOE-sponsored operations took place.

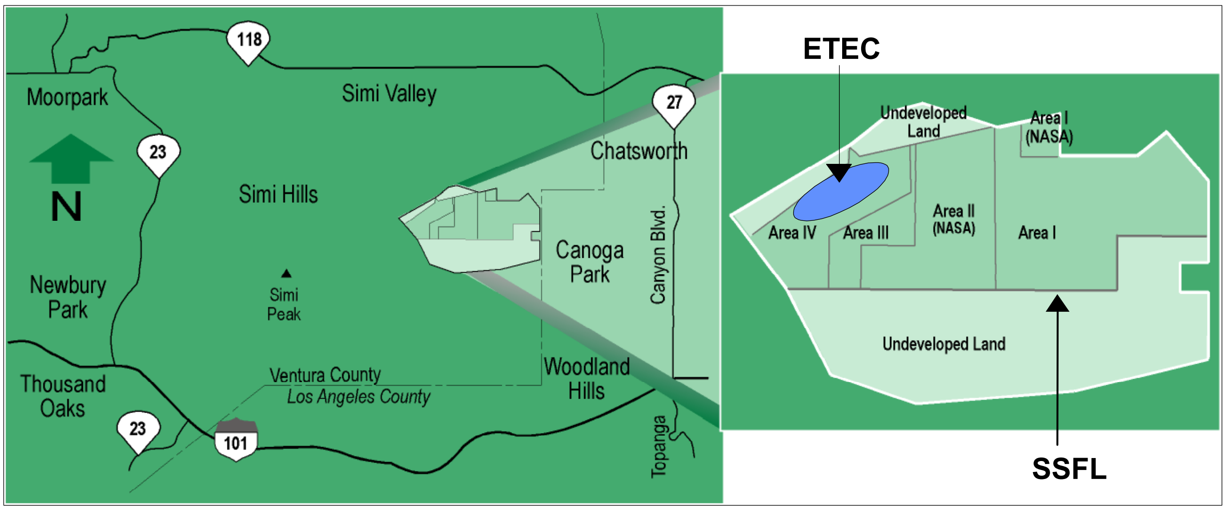

Figure 1-1. Location of SSFL, Area IV, and ETEC

DOE and its predecessor agencies conducted nuclear research and energy development projects at ETEC from the mid-1950s until the mid-1990s. Activities in Area IV of the SSFL sponsored by the DOE included nuclear operations (development, fabrication, disassembly and examination of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium metal experiments for testing of liquid metal fast breeder reactor components. The use of radioactive materials at the SSFL was restricted to Area IV only. As a result of these and other activities, various facilities and locations on the site contain radioactive and chemical contamination. Hazardous materials such as asbestos insulation and lead-based paint may also be present in some buildings.

All nuclear research terminated in 1988. Since then, many of the previously used nuclear facilities and associated site areas have been decontaminated and decommissioned. Decontamination and decommissioning activities at the sodium test facilities began in 1996.

DOE has prepared this environmental assessment (EA) to evaluate the potential impacts of implementing additional cleanup and closure activities. The EA was prepared in accordance with the Council on Environmental Quality's National Environmental Policy Act (NEPA) implementing regulations (40 CFR

Parts 1500-1508) and DOE's NEPA implementing regulations (10 CFR Part 1021).[1] A notice of intent was published in the *Federal Register* on September 15, 2000, announcing DOE's decision to prepare this EA and hold public scoping meetings (65 Fed. Reg. 55949 (2000)).

DOE is issuing this EA as a draft for public comment. Following the receipt and consideration of such comments, DOE will issue a final EA. Based on information in the final EA, DOE will determine whether to issue a finding of no significant impact or a notice of intent to prepare an environmental impact statement.

1.1 PURPOSE AND NEED

DOE has determined that ETEC is surplus to its current needs and is closing the site. However, DOE is responsible for the remaining radioactive and chemical contamination from its activities and is proposing to clean up the site prior to leaving the site. DOE has developed a closure plan that seeks to remove hazardous and radioactive materials and waste resulting from DOE activities at ETEC and turn the site over to Rocketdyne. There are no radiological facilities outside of Area IV. DOE now needs to decide the most appropriate cleanup and closure procedure for the radiological contamination and hazardous materials remaining at ETEC. The chemical contamination at the site will be considered in the Resource Conservation and Recovery Act (RCRA) Facility Investigation process.

1.2 ALTERNATIVES

DOE is proposing to clean up the ETEC site using the DOE cleanup standard for decontamination of radiological facilities and surrounding soils (**Alternative 1**). Using this standard, DOE would ensure that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual (*see* the text box on the following page for an explanation of terms relating to radiation exposure).[2] This additional lifetime cancer risk would result from exposure to no more than a 15-millirem additional radiation dose annually to the maximally exposed individual (assumed to be an individual living on the ETEC site for 40 years). DOE would decontaminate, decommission, and demolish the remaining radiological facilities. DOE would also decommission and demolish the one remaining sodium facility and all of the remaining uncontaminated support buildings for

Cancer Risk from Radiation

Background radiation is radiation from naturally occurring radioactive materials as they exist in nature (such as radon) and cosmic rays from space filtered through the Earth's atmosphere. Other sources of background radiation include medical procedures (x-rays), air travel, consumer and industrial products, and fallout from prior nuclear weapons testing. Individuals in the United States receive approximately 300 millirem annually from background radiation. The probability of incurring cancer as a result of exposure to background radiation is approximately 0.01 or 1 in 100 over a lifetime. Additional information is available in Appendix C.

In this EA, the term "additional theoretical lifetime cancer risk" refers to the potential risk of developing cancer that could result from exposure to radiological contaminants *over and above* the existing risk from exposure to naturally occurring (background) levels of radiation.

[1] Earlier decontamination, decommissioning, and demolition activities at ETEC were conducted pursuant to categorical exclusions issued in accordance with DOE's NEPA regulations (10 CFR Part 1021, Appendix B to Subpart D).

[2] DOE approved the soil release criteria for ETEC in September 1996. A detailed discussion of the soil cleanup standard is found in "Approved Sitewide Release Criteria for Remediation of Radiological Facilities at the SSFL," N001SRR140131, February 18, 1999.

which it is responsible. The ongoing RCRA corrective action program, including groundwater treatment, would continue. Alternative 1 is DOE's preferred alternative.

For this EA, DOE also analyzed an alternative that would clean up the ETEC site using a 1×10^{-6} standard such that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual (**Alternative 2**). This additional lifetime cancer risk would result from exposure to no more than a 0.05-millirem radiation dose annually to the maximally exposed individual. As under the proposed action, DOE would also decommission and demolish the remaining sodium facilities and all of the remaining uncontaminated support buildings for which it is responsible. Ongoing groundwater treatment and the SSFL site-wide RCRA corrective action would continue.

Exposure to Radiation

As a result of past radiological activities, the ETEC site contains radioactive contamination in various facilities and locations. The decontamination activities that would be undertaken under the alternatives analyzed in this EA could expose workers to radiation and contaminated material. These activities could also expose the public to very small quantities of radioactive materials from controlled releases to the atmosphere. Even after decontamination activities were completed, extremely small levels of radioactivity could remain. Radiation may cause a variety of ill health effects in people, including cancer.

To determine whether health effects could occur as a result of radiation exposure from a particular activity and to determine the extent of such effects, the radiation dose must be calculated. An individual may be exposed to radiation externally (through a radiation source outside of the body) and/or internally (from ingesting or inhaling radioactive material). The dose is a function of the exposure pathway (for example, inhalation, ingestion, or external exposure through the skin) and the type and quantity of the radionuclides involved.

The unit of radiation dose for an individual is the *rem*. A *millirem* is 1/1,000 of a rem. The unit of dose for a population is *person-rem* and is determined by summing the individual doses of an exposed population. Dividing the person-rem estimate by the number of people in the population indicates the average dose that a single individual could receive. The impacts from a small dose to a large number of people can be approximated by the use of population (that is, *collective*) dose estimates. Dose estimates are usually derived for both the *maximally exposed individual* (a member of the public located nearest to the site during decontamination, decommissioning, and demolition activities or, following remediation, a person who would live on the site for 40 years) and the *collective population* within 80 kilometers (50 miles) of the site.

After the dose is estimated, the health impact is calculated from current internationally recognized risk factors. The potential health impact is stated in terms of a *latent cancer fatality*. A latent cancer fatality is a fatality resulting from a cancer that was originally induced by radiation but which may occur years after the exposure. Small doses of radiation result in fractional latent cancer fatalities, or only a probability that a latent cancer fatality may be incurred. The lower the fractional latent cancer fatality, the lower the probability that a latent cancer fatality will be incurred. For example, 1×10^{-4} probability of a latent cancer fatality means 1 chance in 10,000 of incurring a latent cancer fatality; 1×10^{-6} probability of a latent cancer fatality means 1 chance in 1 million of incurring a latent cancer fatality.

The Council on Environmental Quality regulations implementing NEPA require agencies to consider the no action alternative as a baseline against which the environmental impacts of the proposed action and alternatives can be measured. For this EA, DOE analyzed the potential impacts of leaving the site in its current state (**No Action Alternative**). Under the No Action Alternative, DOE would conduct no further cleanup of radiological facilities or soil or cleanup of the remaining sodium and other support facilities for which it is responsible. Rather, Rocketdyne would prohibit or control access to contaminated facilities, soil, groundwater, and surface water and continue groundwater treatment. However, the ongoing RCRA corrective action program would continue.

Activities that would be conducted under each of these alternatives are discussed fully in Chapter 3, Proposed Action and Alternatives.

1.3 SCOPING

The public scoping period began with the September 15, 2000, publication in the *Federal Register* of the notice of intent to prepare an EA and continued until October 30, 2000. During the scoping period, DOE conducted public scoping meetings on October 17, 2000, in Woodland Hills, California, and on October 18, 2000, in Simi Valley, California. Information on the scoping meetings was published in local public notices prior to the meetings as well as in mailings to interested parties.

The public was encouraged to comment on the proposed scope of the EA, suggest other site cleanup alternatives, express any concerns regarding ETEC and proposed actions, and provide any other information or comments that DOE should consider in the course of developing the EA. The scoping process was used to help determine issues to be addressed, identify significant issues related to the proposed action, identify and eliminate issues that were not significant or were covered by another environmental review, and develop a range of alternatives for analysis. In fact, DOE added Alternative 2, the 1 x 10^{-6} cleanup standard, as an alternative at the request of stakeholders.

U.S. Environmental Protection Agency (EPA) Cleanup Policy

Although ETEC is not a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site, DOE has determined that all departmental cleanup activities will be conducted consistently with CERCLA (42 U.S.C. 9601 *et seq*), as a matter of policy.

The regulations issued by the EPA for CERCLA state that CERCLA cleanups need to achieve a cleanup level such that there is an upper bound lifetime cancer risk to an individual of between 1 x 10^{-4} to 1 x 10^{-6} resulting from exposure to residual contamination after the cleanup is complete (*see* 40 CFR 300.430(e)(2)(i)(A)(2)). EPA has stated that DOE's 15-millirem annual dose cleanup standard, equating to an increased lifetime cancer risk to an individual of approximately 3 x 10^{-4}, "is consistent with levels generally considered protective in other governmental actions, particularly regulations and guidance developed by EPA in other radiation control programs" (EPA 1997).

More recently, EPA has adopted "very stringent public health and environmental protection standards" for the proposed high-level radioactive waste and spent nuclear fuel repository at Yucca Mountain, Nevada. Under these standards, residents closest to the repository would be exposed to no more than 15 millirem annually from all pathways (EPA Press Release dated June 6, 2001, "Whitman Announces Final Standards for Yucca Mountain on Public Health and Environmental Protection"). Further, EPA has stated that a 25-millirem standard used by the U.S. Nuclear Regulatory Commission for the cleanup of the West Valley Demonstration Project in West Valley, New York, "will result in a residual risk within the [CERCLA] risk range of 10^{-4} to 10^{-6}…" (Letter from Paul A. Giardina, Chief of EPA's Radiation and Indoor Air Branch, to John Greeves, Division of Waste Management, U.S. Nuclear Regulatory Commission, dated July 23, 2001).

Appendix A summarizes the comments received during scoping and DOE's responses to these comments. Appendix B provides a list of agencies and persons consulted regarding the preparation of this EA.

1.4 OTHER OPPORTUNITIES FOR PUBLIC INVOLVEMENT

This EA is being issued in draft and circulated for public comment for a period of 30 days. Comments may be submitted in writing:

- By mail to:

  Michael Lopez
  U.S. Department of Energy
  Oakland Operations Office
  1301 Clay Street, Room 700N
  Oakland, California 94612-4208

- By facsimile to: (510) 637-2031

- By electronic mail to: etec.ea@oak.doe.gov

1.5 ORGANIZATION OF THE EA

The EA consists of six chapters and four appendices. **Chapter 1** is a brief introduction to DOE's purpose and need for action, the alternatives analyzed, and the means by which the public has been and can continue to be involved with the preparation of the document and DOE's decisionmaking process.

Chapter 2 provides background information regarding the history of the site, regulatory requirements involving ETEC site cleanup, the facilities that are the subject of this EA, waste management activities on the site, and the current status of the site.

Chapter 3 describes the proposed action and alternatives analyzed in the EA. This chapter includes a table that summarizes and compares the potential environmental impacts associated with each alternative.

Chapter 4 describes the affected environment and environmental consequences that could occur under each alternative. For each resource area, the EA describes the current conditions at the site and the potential environmental impacts of implementing the 3×10^{-4} cleanup standard, the 1×10^{-6} cleanup standard, and the No Action Alternative. The resource areas analyzed are land use, geology and soils, air quality, water quality and water resources, human health, biological resources, cultural resources, noise and aesthetics, socioeconomics, waste management, transportation, environmental justice, and cumulative impacts.

Chapter 5 addresses unavoidable adverse environmental impacts, the relationship of short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources.

Chapter 6 contains a list of the documents used in the preparation of this EA.

Appendix A summarizes scoping comments and provides DOE responses. **Appendix B** lists the individuals and agencies consulted and contacted during the preparation of this EA. **Appendix C** provides additional information on radiation and human health. **Appendix D** identifies endangered, threatened, and sensitive species that have been observed or that could occur at the SSFL.

2.0 BACKGROUND

2.1 HISTORY OF THE SITE

In the late 1940s, North American Aviation acquired land in the Simi Hills between the Simi and San Fernando Valleys. That land, now known as the SSFL, was used primarily for the testing of rocket engines. Atomics International, a division of North American Aviation, was formed in 1955, and part of Area IV was set aside and used for nuclear reactor development and testing. In 1984, Rocketdyne merged with Atomics International. The Boeing Company purchased Rocketdyne in 1996.

Activities in Area IV started in the mid-1950s; until 1964, these activities were primarily related to sodium-cooled nuclear power plant development and development of space power systems with sodium and potassium as coolants. ETEC (originally known as the Liquid Metal Engineering Center) was formed in the mid-1960s as an Atomic Energy Commission (now DOE) laboratory for the development of liquid metal heat transfer systems in support of the Liquid Metal Fast Breeder Reactor Program. Nuclear operations at ETEC included 10 nuclear research reactors, 7 critical facilities, the Hot Laboratory, the Nuclear Materials Development Facility, the Radioactive Materials Handling Facility (RMHF), and various test and nuclear material storage areas. As a result of DOE nuclear activities, several ETEC facilities became radioactively activated and/or contaminated.

Activation

Neutrons are electrically neutral subatomic particles. In a nuclear reactor, neutrons from uranium (contained in cylindrical fuel pellets and placed in fuel assemblies) strike other uranium atoms, causing them to split into parts. This produces heat, radioactive fission products, gamma rays, and more free neutrons. The neutrons produced by the fission process sustain the nuclear reaction by striking other uranium atoms in the fuel, causing additional atoms to split. During nuclear reactor operations, some neutrons generated by the fission process leave the reactor core. These neutrons enter the concrete shielding surrounding the reactor. This interaction causes some elements in the concrete to gain neutrons and become radioactive themselves. At two ETEC facilities (Buildings 4059 and 4024), the shielding concrete contains low levels of activation products as a result of the nuclear operations that were conducted in those buildings in the past. The activation products produced in shielding and structural materials (*e.g.*, rebar) are tritium, iron-55, nickel-63, cobalt-60, and europium-152/154.

All nuclear operations ended in 1988. Since that time, DOE-funded activities have focused on decontamination and decommissioning of the ETEC facilities and offsite disposal of waste. Remediation of ETEC is now in its final stages. Three facilities still contain residual radiological contamination and/or activation.

DOE also conducted large-scale heat transfer and fluid mechanics experiments, using nonradioactive sodium metal in a molten state at ETEC. While not a contaminant, sodium metal is the most significant hazardous chemical substance remaining at ETEC. Most of the sodium has been removed and shipped off site for reuse at other industrial sites. Only one sodium facility remains.

Hazardous materials such as asbestos insulation and lead-based paint were also used in ETEC facilities.

In addition to DOE-sponsored activities, the SSFL has also been used by Boeing, the National Aeronautics and Space Administration (NASA), and the Department of Defense for rocket and laser testing, which have also resulted in hazardous chemical contamination. DOE is responsible only for contamination resulting from DOE-sponsored activities. Contamination on other portions of the SSFL is the responsibility of other federal agencies and private entities.

2.2 REGULATORY FRAMEWORK

Under the authority of the Atomic Energy Act (42 U.S.C. 2011 *et seq*.), DOE is self-regulating and is responsible for establishing a comprehensive health, safety, and environmental program for managing its facilities through the promulgation of regulations and the issuance of DOE orders. DOE derives this authority from Section 161 of the Act (42 U.S.C. 2201). In general, DOE orders set forth policies, programs, and procedures for implementing policies.

Decontamination activities are governed by DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. Chapters 2 and 4 of this order prescribe an extensive and detailed methodology for restoring DOE sites. DOE Order 435.1, *Radioactive Waste Managemen*t, is also applicable to the cleanup of the radiological facilities at ETEC. Pursuant to this order, DOE has prepared and issued the *ETEC Closure Program – DOE Order 435.1 Implementation Plan*.

To verify that cleanup policies and standards are being followed, DOE has contracted with the Oak Ridge Institute for Science and Education to conduct and document independent verification surveys at ETEC facilities. The Oak Ridge Institute for Science and Education has established an Environmental Survey and Site Assessment Program that conducts radiological surveys and environmental assessments for government agencies working to clean up facilities contaminated with hazardous or radioactive materials. The Institute verifies that the sites are free of any contamination that may be harmful to the public or the environment by using a combination of laboratory and field capabilities to control all aspects and phases of the survey process. Institute staff follow systematic procedures to collect samples for analyses in their laboratory. Should these analyses indicate that contaminants remain above acceptable levels, the Institute recommends actions to be taken.

As an Agreement State under the provisions of the Atomic Energy Act, the State of California also has jurisdiction over some radiological activities at ETEC. The California Department of Health Services oversees the radioactive materials license held by Rocketdyne, radioactive facility cleanup, and environmental monitoring. The Department of Health Services also conducts unannounced inspections to verify the amounts and types of radioactive materials being used onsite, evaluates radiation exposure to employees and the general public, and reviews records related to radiation usage at the site. In particular, this department concurs with DOE findings that former DOE radiological facilities at ETEC that have been decontaminated and decommissioned may be released for unrestricted use in accordance with state regulatory standards.

Cleanup of chemical contamination at ETEC is regulated under the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901 *et seq.*). As part of Area IV of the SSFL, ETEC is subject to several ongoing RCRA actions: closure of inactive RCRA treatment, storage, or disposal units; compliance/permitting of active RCRA units; groundwater characterization and remediation; and RCRA corrective actions. These activities are under the jurisdiction of the California Environmental Protection Agency's Department of Toxic Substances Control, pursuant to delegated authority from the U.S. Environmental Protection Agency (EPA). The Department of Toxic Substances Control is preparing an environmental impact report, in accordance with the California Environmental Quality Act, for the corrective measures to be undertaken by the RCRA Corrective Action Program for all of the SSFL,

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including ETEC. The environmental impact report will be based in part on information generated from the characterization of chemical releases at SSFL performed in the RCRA corrective action process.

Compliance with RCRA

RCRA establishes a comprehensive regulatory program for the management of hazardous waste and the cleanup of active sites where releases have occurred. RCRA requires that hazardous wastes be treated, stored, and disposed of so as to minimize present and future threats to human health and the environment. RCRA applies mainly to active facilities that generate and manage hazardous wastes.

DOE facilities that store, treat, or dispose of hazardous waste or waste containing hazardous constituents are subject to RCRA requirements and must obtain a permit from EPA or from states that have been delegated permit authority by EPA. The Federal Facility Compliance Act, 42 U.S.C 6961, waives DOE's sovereign immunity by allowing states to impose fines and penalties for RCRA violations.

RCRA compliance programs include the following activities: permitting storage, treatment, and disposal facilities; closing inactive RCRA-permitted facilities; and undertaking corrective actions to address chemical contamination at active sites. Developing corrective actions involves the preparation of a RCRA facility assessment, facility investigation, corrective measures study, and corrective measures implementation. Facility assessments are used to identify solid waste management units (defined as any location where hazardous materials were used, stored, or handled) and areas of concern.

In 1989, a RCRA facility assessment identified solid waste management units and areas of concern at the SSFL. The SSFL corrective action process is currently at the RCRA facility investigation stage.

Because the cleanup of the chemical contamination at ETEC is being undertaken in the larger context of the SSFL and under a separate regulatory process, these activities are not part of the proposed action or alternatives analyzed in this EA. DOE has analyzed the cumulative impacts of the cleanup of the ETEC facilities for which DOE is responsible and the ongoing RCRA cleanup at the SSFL (*see* Section 4.14).

Other federal, state, and local agencies are also involved in various oversight activities at ETEC and the SSFL:

- ***EPA's Office of Radiation and Indoor Air*** is the lead agency responsible for enforcing those provisions of the National Emissions Standards for Hazardous Air Pollutants (NESHAP) related to radionuclides. Although nuclear operations are no longer conducted at ETEC, these standards also apply to ongoing decontamination activities that might produce air emissions. DOE submits annual NESHAP reports to EPA that document radiological releases from the site.

- The ***Regional Water Quality Control Board (Los Angeles Region)*** is the lead agency responsible for regulating surface water discharge activities at the SSFL. Under the authority of the Clean Water Act, 33 U.S.C. 1251 *et seq*., and the National Pollutant Discharge Elimination System (NPDES), the board sets maximum limits for chemical and radiological contaminants in surface water being discharged from the SSFL. These limits, along with requirements for sampling, are incorporated into the site's NPDES permit, which must be renewed every 5 years. The board also shares responsibilities with the California Department of Toxic Substances Control for monitoring discharges to the groundwater.

- The ***Ventura County Environmental Health Division*** is responsible for enforcing regulations on hazardous waste generation and storage, pursuant to an agreement with the State of California.

- The ***Ventura County Air Pollution Control District*** is the lead agency responsible for regulating nonradioactive air emissions at the SSFL. The district is responsible for establishing and enforcing local air pollution regulations that meet or exceed requirements of the federal and California State Clean Air Acts and the California Health and Safety Code. The district also issues permits that establish requirements for construction, modification, and operation of equipment and processes that may result in air emissions. The SSFL currently has five permits covering various process equipment and groundwater treatment facilities. Other responsibilities of the district include regulating asbestos removal projects, implementing the vehicle trip reduction program, and overseeing the state-mandated Air Toxics "Hot Spot" Program that requires facilities to inventory all toxic materials that could result in airborne releases.

2.3 FACILITY DESCRIPTIONS

At its mission peak, ETEC consisted of over 200 facilities. Since the decision to close ETEC in 1996, many facilities have been decontaminated, decommissioned, and demolished. These activities were conducted under categorical exclusions pursuant to DOE's NEPA regulations (10 CFR Part 1021, Appendix B to Subpart D). Approximately 64 structures remain.

Three radiological facilities (comprising a total of 13 buildings) and one sodium facility are the subject of this EA. In addition, 50 other DOE support facilities (for example, office and storage buildings, warehouses, parking lots, electrical substations) are proposed for demolition. Figure 2-1 shows the locations of these facilities within ETEC. This section describes these facilities.

2.3.1 Radiological Facilities

The three radiological facilities are the RMHF Complex, Building 4059, and Building 4024. In addition, two other former radiological ETEC facilities have already been decontaminated and released for unrestricted use by DOE, with the concurrence of the California Department of Health Services. One other facility has been decontaminated and is pending release by DOE. Because these facilities are no longer contaminated but have not been demolished, they are included in the discussion of other DOE support facilities (*see* Section 2.3.3).

2.3.1.1 Radioactive Materials Handling Facility Complex

The RMHF complex consists of nine different buildings that are used for the following purposes: decontamination and packaging (Building 4021); operations and storage vaults (Building 4022); offices (Building 4034); health physics services (Building 4044); enclosed storage (Buildings 4075, 4621, and 4665); covered storage (Building 4688); and security (Building 4658). A rainwater runoff catch basin (referred to as Building 4614) is also included within the approximately 12,000-square-meter (3-acre) RMHF. The RMHF has been in continuous operation as a storage and handling facility for radioactive materials and waste since the late 1950s. It is a RCRA-permitted facility. Operations at the RMHF include waste characterization, limited treatment, packaging, and temporary storage of radioactive and mixed waste materials, which are shipped offsite to appropriate approved disposal facilities. The facility is radiologically contaminated from past operations, including the storage of both new fuel and irradiated fuel.

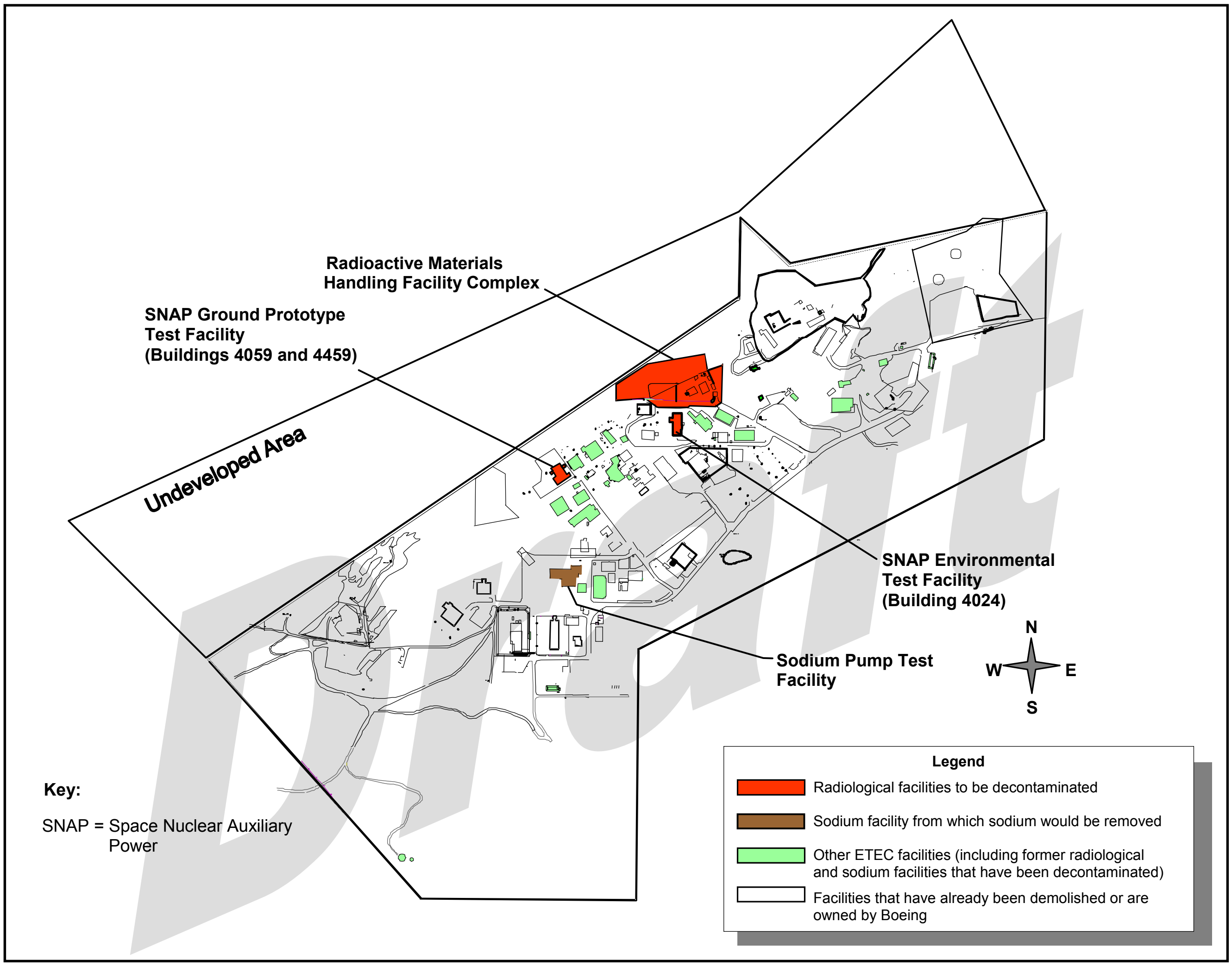

Figure 2-1. ETEC Radiological, Sodium, and Other Uncontaminated or Decontaminated Facilities

Radioactive Waste Types at ETEC

Activities at ETEC have resulted in the generation of three types of radioactive waste: low-level radioactive waste (LLW), mixed low-level waste (MLLW), and transuranic (TRU) waste.

LLW includes all radioactive waste that is not classified as high-level radioactive waste, spent nuclear fuel, TRU waste, uranium and thorium mill tailings, or waste processed from ore. Most LLW consists of relatively large amounts of waste materials contaminated with small amounts of radionuclides, such as contaminated equipment, protective clothing, paper, rags, packing material, and soil. Most LLW contains short-lived radionuclides and generally can be handled without additional shielding or remote handling equipment.

MLLW is LLW that also contains hazardous components regulated under RCRA. MLLW results from a variety of activities, including the processing of nuclear materials used in energy research and development.

TRU waste is waste that contains alpha particle-emitting radionuclides with atomic numbers greater than uranium (92) and half-lives greater than 20 years in concentrations greater than 100 nanocuries per gram of waste. Some TRU waste also contains hazardous components regulated under RCRA, making it a mixed waste. In accordance with earlier DOE decisions, TRU waste will be disposed of at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico.

The RMHF is in active use. Operated safely since its initial use, the RMHF was designed and constructed to withstand naturally occurring hazards including wind, earthquakes, landslides, and rainwater flooding. Adequate systems and controls are in place to minimize direct radiation exposure to personnel and the release of radioactive material into the environment. All potential hazards have been identified and engineering controls have been incorporated into the operation of the facility to ensure that safe operation is maintained at all times. Design safety features include security and radiation controls, evacuation routes, shielding provisions, ventilation and filtration, site water runoff control, alarm instrumentation, and fire protection. Ventilation from work areas in the RMHF is exhausted through high efficiency particulate air filters and released from a stack. Emissions from this exhaust stack are monitored and reported.

2.3.1.2 Building 4059

Building 4059, the Space Nuclear Auxiliary Power Ground Prototype Test Facility, was built in 1962-1963 for development testing of space nuclear auxiliary power reactors. It has one reactor vault in the basement (another vault in the basement did not house a reactor). Testing of the reactor was conducted in 1968-1969. The reactor vault was made radioactive by neutron activation during the reactor tests. At the end of the test operations, the reactor core and control system were removed, sent to an onsite examination facility for inspection, and then shipped offsite for disposal. Sufficient decontamination was done at that time to make a portion of the facility available for other use. In 1999, the above-grade portion of the building and the underground, nonactivated portions of the basement were decontaminated and surveyed for release for unrestricted use. Building 4459 (a storage building) is within the fence line boundary of Building 4059.

2.3.1.3 Building 4024

Building 4024, the Space Nuclear Auxiliary Power Environmental Test Facility, contained two reactors, which were operated in two different vaults. Criticality tests were also conducted in this facility. As in

Building 4059, the reactor vaults were made radioactive by neutron activation during the reactor tests. The reactors and associated equipment have all been removed and disposed of as radioactive waste. Some activated concrete shielding and reinforcing steel rods remain in the vaults.

2.3.2 Sodium Pump Test Facility (Building 4462)

The Sodium Pump Test Facility (SPTF) has two circulating sodium loops with transient capability and was used to test large sodium pumps, valves, and flow meters. It currently contains approximately 197,000 liters (52,000 gallons) of liquid sodium. All DOE-sponsored activities at the facility have ceased. With DOE authorization, however, Rocketdyne used the SPTF under a commercial contract to perform electromagnetic pump testing using sodium. This project, which did not involve the use of radioactive materials, was completed in late 2001.

Sodium

Metallic sodium is an excellent heat transfer medium and, for that reason, has been used as a coolant in nuclear reactors. It is not radioactive. Sodium does react vigorously with water, steam, oxygen, carbon dioxide, and several other common substances. The initial and secondary reactions may be violent. Sodium can burn spontaneously in air, releasing caustic fumes.

Activities at the SPTF have been classified as low-hazard because they present minor onsite and negligible offsite impacts to people or the environment. The facility was designed in accordance with applicable codes, and the Rocketdyne system of procedures applies to activities undertaken in the facility. These procedures include environment, safety, and health procedures, which ensure compliance with applicable federal, state, and local rules and regulations. Training of personnel and performance of operations in accordance with the procedures reduce the potential for accidents during operations.

Other sodium facilities at ETEC included the Liquid Metal Development Loops, Sodium Components Test Laboratory, Sodium Component Test Installation Complex, and Former Sodium Disposal Facility. The sodium has been removed from all of these facilities and they have either been demolished or are proposed for demolition. Because they no longer contain any sodium, the former sodium facilities that have not been demolished but that are proposed for demolition are included in the discussion of other DOE support facilities (*see* Section 2.3.3).

2.3.3 Other DOE Support Facilities

Other facilities were constructed at ETEC to support DOE programs there. The structures include:

- Office buildings
- Electrical substations
- Storage buildings
- Emergency generator shelters
- Time card buildings
- Fuel oil storage tanks and piping systems
- Foundations
- Vaults and berms
- Former sodium facilities from which all sodium has been removed

Most of these facilities were not in radiological areas and have been demolished. Currently, approximately 50 uncontaminated support facilities are still present at the ETEC site (Table 2-1). These facilities include the sodium facilities from which the sodium has already been removed and two former

Table 2-1. Other Support Facilities at ETEC

Building	Building Name/Description
4012	X-Ray Facility / Storage
4013	Seismic Test Facility
4014	Storage Facility
4019	Equipment Storage and Computer Center
4027	Former Weld Shop
4029	Sodium/Hazardous Waste Storage
4032	Liquid Metal Development Loops 1 Lab
4038	ETEC Headquarters/Office Building.
4039	Office Building
4042	Liquid Metal Fast Breeder Reactor Development Testing
4057	Liquid Metal Development Loops 2 Lab
4133	Hazardous Waste Treatment Facility
4228	Power Pak
4334	Kalina Control Room
4335	Kalina Turbine Generator Bldg
4354	Control Element Test Structure
4355	Sodium Components Test Installation Complex Control Center/Offices
4356	Sodium Component Test Installation
4357	Sodium Component Test Installation Storage
4358	Sodium Component Test Installation Support Building
4457	(Foundation and Pit only)
4459	ETEC Storage
4461	SPTF Motor Generator Building
4463	Component Handling and Cleaning Facility
4473	Hydraulic Test Facility
4573	Parking Lot
4626	Warehouse
4641	Warehouse
4663	(Foundation only)
4683	Electrical Substation for Building 4143
4487	Office Building
4710	Sodium Component Test Installation Power Pak Cooling Tower
4713	Electrical Substation for Buildings 4012 & 4013
4719	Electrical Substation for Building 4019
4725	Electrical Substation for Buildings 4024 & 4025
4727	Electrical Substation for Buildings 4027, 4032, 4036
4742	Electrical Substation for Buildings 4023 & 4042
4756	Electrical Substation for Building 4355
4757	Electrical Substation for Buildings 4038 & 4057
4759	Electrical Substation for Building 4059
4760	Electrical Substation for Building 4462
4763	Electrical Substation near Building 4030
4780	Electrical Substation for Building 4463
4805	Timeclock Shack by Sodium Component Test Installation Building 4026
4863	Hydraulic Test Facility
4883	Electrical Substation at Building 4726 Substation
	Electrical Substation for Buildings 4030 and 4041
	Electrical Substation for Building 4228 Power In
	Electrical Substation for Building 4228 Power Out
	Electrical Substation near Building 4015

radiological facilities that have been released by DOE (with the concurrence of the California Department of Health Services) but not yet demolished. Although these facilities do not contain radiological contamination or sodium, some do contain hazardous materials that are typical of those found in comparable commercial or industrial facilities such as asbestos and lead-based paint.

2.4 WASTE MANAGEMENT ACTIVITIES

Small amounts (approximately 50 cubic meters [1,765 cubic feet] in fiscal year 2001) of LLW continue to be generated each year at ETEC as a result of ongoing site closure activities. MLLW is not routinely generated (5 cubic meters [176 cubic feet] of MLLW were generated in fiscal year 2001). TRU waste is no longer generated at the ETEC site.

Currently, DOE sends LLW generated at ETEC to DOE disposal sites (the Nevada Test Site near Las Vegas, Nevada and the Hanford Site in Richland, Washington), or Envirocare, a permitted commercial radioactive disposal facility in Clive, Utah, for disposal in accordance with an earlier DOE decision made pursuant to the *Environmental Assessment of Off-Site Transportation of Low-Level Waste from Four California Sites* (LLW EA) and associated finding of no significant impact. DOE sends most MLLW generated at ETEC to Envirocare. At present, approximately 11 cubic meters (388 cubic feet) of TRU waste are stored onsite at ETEC. DOE will send its TRU waste from ETEC to the WIPP near Carlsbad, New Mexico, in accordance with an earlier DOE Record of Decision made pursuant to the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (WIPP SEIS-II) (63 Fed. Reg. 3624 (1998)).

Radioactive Waste Transportation Analysis

Additional volumes of LLW would be generated as a result of Alternatives 1 and 2; very small amounts of MLLW could also be generated. The shipment of LLW from ETEC to Nevada Test Site or Hanford Site was addressed in DOE's earlier LLW EA. The shipment of MLLW from ETEC to either of these sites was addressed in DOE's *Waste Management Programmatic Environmental Impact Statement*, DOE/EIS-0200-F, May 1997. The results of these analyses are incorporated by reference and the potential impacts of offsite transportation of LLW and MLLW will not be addressed in this EA.

No additional TRU waste is expected to be generated under any of the alternatives. The shipment of TRU waste from ETEC to WIPP was analyzed in the WIPP SEIS-II and the results of that analysis are incorporated by reference. The potential impacts of offsite transportation of TRU waste will not be addressed in this EA.

Small amounts of hazardous waste are generated (1 cubic meter [35 cubic feet] in fiscal year 2001) and disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA and an earlier DOE Record of Decision made pursuant to the *Waste Management Programmatic Environmental Impact Statement*, DOE/EIS-0200-F, May 1997 (63 Fed. Reg. 41810 (1998)). Nonhazardous debris waste is also generated at ETEC (50 cubic meters [1,766 cubic feet] in fiscal year 2001). This type of debris includes asphalt, concrete, and building materials. Debris waste is disposed of at a local municipal landfill.

The ETEC has implemented a Waste Minimization and Pollution Prevention Awareness Program, which includes orientation programs and refreshers, specialized training, and incentive awards and recognition. This program has resulted in the following achievements:

- Oils used in motor vehicles and compressors are shipping to vendors for recycling.
- Usable scrap metal from nonradiological control areas is salvaged using a comprehensive segregation and screening procedure.

- A chemical/material exchange system is linked to the purchasing system to prevent the unnecessary purchase of hazardous materials.
- Empty product drums are returned to the vendor for reuse when practical.
- At the SSFL, approximately 80 percent of office paper and aluminum cans are recycled as a result of increased environmental awareness. In calendar year 2000, 3.9 metric tons (4.3 tons) of white paper and 2.2 metric tons (2.4 tons) of aluminum cans were recycled.

In July 2000, the Secretary of Energy suspended the unrestricted release for recycling of all metals from radiological areas within DOE facilities. This suspension remains in effect pending the outcome of an environmental impact statement on the unrestricted release of such materials from DOE sites. A notice of intent to prepare an environmental impact statement on DOE policy alternatives for the disposition of radioactively contaminated scrap metals was issued on July 12, 2001 (66 Fed. Reg. 36562 (2001)).

2.5 CURRENT STATUS OF THE SITE

The current status of ETEC is described fully in the *Site Environmental Report for Calendar Year 2000*. In general, ongoing environmental monitoring at the site demonstrates that the SSFL does not pose any significant radiological impact on the health and safety of the general public. All significant potential pathways are monitored, including airborne, direct exposure, groundwater, surface water, waste disposal, and recycling pathways. Results of these monitoring activities are contained in Chapter 4 of this EA and in the 2000 Site Environmental Report.

Since 1988, DOE-funded activities have focused on decontamination and decommissioning of the ETEC facilities and offsite disposal of waste. Three facilities still contain residual radiological contamination and/or activation. Only one sodium facility remains.

The SSFL became subject to the RCRA corrective action process in 1989. EPA has performed the preliminary assessment report and the visual site inspection portions of the RCRA facility assessment process. The California Department of Toxic Substances Control has RCRA authorization and has become the lead agency in implementing the corrective action process for the SSFL. Currently, the SSFL RCRA corrective action program is at the RCRA Facility Investigation stage.

Soil contamination. Remediation of hazardous chemical contamination in soil at Area IV will be undertaken in accordance with RCRA. Based on an approved corrective measures study, which follows the RCRA facility investigation (RFI) stage, Rocketdyne will prepare a corrective measures implementation plan that documents remediation requirements for hazardous chemical contamination in Area IV soil.

Groundwater contamination. An extensive groundwater remediation program is ongoing at the SSFL, including Area IV and ETEC. The major groundwater contaminant in Area IV is trichloroethylene (TCE). Interim measures have been implemented to pump and treat areas of known groundwater contamination. In Area IV, contaminated wells are pumped and contaminated groundwater is treated using a granulated activated charcoal filtration system. Groundwater is monitored, sampled, and analyzed regularly. While the pump-and-treat activities are being performed on an interim basis, it is expected that this type of activity may continue under the RCRA corrective measures implementation plan.

Surface water contamination. Surface water is discharged regularly under a NPDES permit administered by the Regional Water Quality Control Board. The only contaminant of concern previously detected in surface water is mercury in sediment that can be mobilized during high flow. Small weirs and settling ponds are in place to prevent the transport of mercury offsite. Surface water and institutional controls to restrict access to contamination at levels of concern will remain in place until monitoring indicates that additional releases of mercury at levels greater than the NPDES permit limit are no longer possible.

All remediation of soil, groundwater, and surface water chemical contamination will be performed pursuant to the RCRA process under the jurisdiction of the California Department of Toxic Substances Control. Those activities are not the subject of this EA.

3.0 PROPOSED ACTION AND ALTERNATIVES

3.1 INTRODUCTION

DOE analyzed two cleanup and closure alternatives and the No Action Alternative, in accordance with the Council on Environmental Quality regulations implementing NEPA (40 CFR Parts 1500-1508) and DOE's NEPA implementing regulations (10 CFR Part 1021).

Under **Alternative 1**, DOE would clean up the ETEC site using the DOE cleanup standard for decontamination of radiological facilities and surrounding soils. Using this standard, DOE would ensure that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual (assumed to be an individual living on the site for 40 years). This additional lifetime cancer risk would result from exposure to no more than an additional 15-millirem radiation dose (above background) annually to the maximally exposed individual. DOE would also decommission and demolish the remaining sodium facility and decommission and demolish all of the remaining uncontaminated support buildings for which it is responsible. The SSFL RCRA corrective program (including the ongoing groundwater treatment) would continue. Alternative 1 is DOE's preferred alternative. This alternative is described fully in Section 3.2.

Understanding Scientific Notation

Scientific notation is based on the use of positive and negative powers of 10. A number written in scientific notation is expressed as the product of a number between 1 and 10 and a positive or negative power of 10.

Examples:
5,000 would be written as 5×10^{3}
0.005 would be written as 5×10^{-3}

In this EA, scientific notation is used to express any number lower than 10^{-2} (0.01).

Under **Alternative 2**, DOE would clean up the ETEC site using a 1×10^{-6} standard such that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual. This additional lifetime cancer risk would result from exposure to no more than an additional 0.05-millirem radiation dose (above background) annually to the maximally exposed individual. As under the preferred alternative, DOE would also decommission and demolish the remaining sodium facility and decommission and demolish all of the remaining uncontaminated support buildings for which it is responsible. The SSFL RCRA corrective program, (including the ongoing groundwater treatment) would continue. This alternative is described fully in Section 3.3.

Under the **No Action Alternative**, DOE would conduct no further cleanup of radiological facilities, soil, or the remaining sodium and other support facilities for which it is responsible. Rather, Rocketdyne, as the owner of the site, would prohibit or control access to contaminated facilities, soil, groundwater, or surface water and would continue groundwater treatment. This alternative is described fully in Section 3.4.

DOE also considered other alternatives that were later found to be unreasonable. These include (1) cleanup of the entire SSFL, (2) the disposal of all radiological facilities as radioactive waste regardless of contamination levels, (3) cleanup of the site to industrial levels, and (4) cleanup of the site to background levels. These alternatives and the reasons why DOE considers them to be unreasonable are described in Section 3.5.

Section 3.6 summarizes the impacts that could occur under each of the alternatives analyzed.

3.2 ALTERNATIVE 1: CLEANUP AND CLOSURE UNDER DOE STANDARD (PREFERRED ALTERNATIVE)

Implementation of Alternative 1 would last approximately 5 years. Activities performed under Alternative 1 would involve:

- Decontamination and demolition of the three remaining radiological facilities;
- Soil remediation such that residual radioactive contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual (which relates to a 15-millirem dose to the maximally exposed individual annually);
- Sodium removal and demolition of the SPTF;
- Demolition of all remaining uncontaminated DOE support facilities; and
- A final, independent survey of Area IV to verify that the site has been cleaned up to the remediation goal. The California Department of Health Services will participate in this survey.

Implementation of Alternative 1 would result in the generation of radioactive, hazardous, and nonhazardous debris waste volumes, as indicated in Table 3-1.

Table 3-1. Waste Volumes Generated Under Alternative 1

Waste Type	Waste Volume (cubic meters)[a]
Low-Level Radioactive Waste	**7,500**
Building Decontamination	2,000
Soil Remediation (3×10^{-4} Standard)	5,500
• RMHF	5,500 cubic meters
• Building 4059	None expected
• Building 4024	None expected
• Remainder of Area IV	0
Mixed Low-Level Radioactive Waste	**20**
Hazardous Waste	**5**
Nonhazardous Debris Waste (Uncontaminated)	**25,300**

a. To convert cubic meters to cubic feet, multiply by 35.3.

The volume of soil that would need to be remediated in the implementation of Alternative 1 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 1.2 square kilometers (290) acres of Area IV, plus additional soil samples taken in 2000 at the RMHF. The 149 soil samples taken were assumed to be characteristic of surface soil on Area IV. These soil samples provide a distribution of cesium-137, the primary contaminant of concern (as explained more fully in Chapter 4). Conservatively assuming that these predominantly surface samples are representative of all Area IV soil down to bedrock, DOE estimated the volume of soil that would need to be excavated to meet the 3×10^{-4} additional lifetime cancer risk (15-millirem annual dose) standard. Based on this dataset, DOE calculated that some soil remediation would be required for the RMHF, but no soil remediation would be required for Buildings 4024 and 4059 or for the remainder of Area IV because all soil in those areas is already below the 3×10^{-4} goal. For purposes of analysis, DOE assumed that all excavated soil would be managed as LLW and shipped offsite.

3.2.1 Decontamination and Demolition of the Remaining Radiological Facilities and Soil Remediation

As discussed in Section 2.3, the ETEC site has three radiological facilities, consisting of 13 separate radiological buildings. These are the RMHF complex (consisting of nine buildings and a rainwater runoff catch basin), the Space Nuclear Auxiliary Power Ground Prototype Test Facility (Buildings 4059 and 4459), and the Space Nuclear Auxiliary Power Environmental Test Facility (Building 4024). Building decontamination and decommissioning is conducted in accordance with DOE Order 5400.5.

3.2.1.1 Radioactive Materials Handling Facility Complex

The RMHF is a RCRA-permitted facility used for waste management activities. Under Alternative 1, DOE would continue to operate the facility until all radioactive waste was shipped offsite. DOE would then survey the buildings that comprise the RMHF complex, decontaminate them as necessary, resurvey the buildings (with verification by the Oak Ridge Institute for Science and Education and the California Department of Health Services), and demolish them. DOE would package any radioactively contaminated RMHF debris and ship it offsite for disposal at a DOE approved site. Contaminated material in the drainage channel and holding pond would also be removed, packaged, and shipped offsite. Soil remediation would begin after the building debris was removed from the area.

Decontamination and Demolition

Decontamination of the RMHF complex is expected to involve the following:

- Conduct Initial Radiation Surveys – Radiation and dose levels of equipment, piping, and structural elements would be surveyed. Samples would be collected for preliminary hazardous waste identification purposes and other analyses.

- Perform Pre-Decontamination Activities – Airlocks, tenting, temporary shielding, and temporary ventilation systems would be installed.

- Vacuum Surfaces – Contaminated materials and equipment would be removed and the floors would be vacuumed.

- Decontaminate External Surfaces – Surface contamination would be removed using pneumatic scabble equipment or other methods as needed.

- Detect Presence of Liquids – Ultrasound sonic devices would be used to detect the presence of liquid in piping and equipment.

- Wipe Down Surfaces – All floor, wall, ceiling, and equipment surfaces would be wiped to remove loose contamination.

- Remove Major Equipment – Tanks, vessels, pumps, and other major equipment would be removed.

- Remove Valves – Valves would be cut from pipes with a torch, or mechanical means, and loaded into shipping containers.

- Remove Piping – Piping would be removed, size-reduced, and loaded into shipping containers.

- Strip Out Mechanical and Electrical Devices – Small pieces of mechanical and electrical equipment would be removed and loaded into shipping containers.

- Conduct Final Survey – Surface contamination and dose levels of equipment, piping, and structural elements would be surveyed. Samples may be collected for hazardous waste characterization and other analyses.

- Verification Surveys – Verification surveys would be conducted by independent sources such as EPA, the Oak Ridge Institute for Science and Education, and the California Department of Health Services.

- Package Waste for Shipment – Wastes generated and packaged during decontamination would be further prepared for offsite shipment.

LLW and very small amounts of MLLW would be generated as a result of these activities. In addition to radiological contamination, the RMHF complex may contain hazardous materials such as lead-based paint, asbestos insulation, polychlorinated biphenyl (PCB) light fixture ballasts, solvents, oils, and greases. These would be removed and disposed of as hazardous waste.

After radiological contamination was removed, DOE would remove other components, segregate materials, and dispose of the materials. These components would include such support systems as wiring, electrical components, and remaining auxiliary systems components. The facilities would be demolished. Uncontaminated debris would be disposed of in a local municipal sanitary landfill.

Soil Remediation

Following the decontamination and demolition of the RMHF complex, soil surveys would be conducted to determine the level and extent of any radioactive soil contamination in the area. Those areas with contamination above the cleanup goal for this alternative would be excavated, with the resulting material packaged as LLW. Approximately 5,500 cubic meters (194,230 cubic feet) of soil would be excavated from around the RMHF and disposed of as LLW at a DOE disposal site (*see* Table 3-1). After a verification survey confirmed that the remediation goal had been met, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.[3]

Under Alternative 1, the remediation goal for Area IV of the SSFL would be an additional theoretical lifetime risk of a latent cancer fatality to the maximally exposed individual of no greater than 3×10^{-4} as a result of exposure to the radiological contamination remaining on the site.[4] Using this standard, the maximally exposed individual would receive no more than an additional 15-millirem radiation dose each year (above background) due to exposure to residual radiological contamination at ETEC. For perspective, it is estimated that the average individual in the United States receives a dose of about 300 millirem each year from natural sources of radiation. Of this, between 30 and 50 millirem are due to

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[3] The onsite borrow area is located in a small meadow in the southwest corner of Area IV. A total of 50,460 cubic meters (1.8 million cubic feet) are available from this onsite borrow area for all SSFL environmental projects. Grading Permit Modification, Former Sodium Disposal Facility Interim Action, Rocketdyne-Santa Susana, CUP 248: Permit No. 8664 (July 2, 1999).

[4] In accordance with its 3×10^{-4} cleanup standard, DOE has remediated the soil around all former ETEC radiological facilities to below this level. Thus, after cleanup of the RMHF to this standard, all of Area IV would meet this level of protection, or better. The California Department of Health Services has concurred with this release limit.

exposure to naturally occurring radionuclides in clean soil. This exposure to radionuclides in clean soil results in an annual theoretical fatal cancer risk of 6 x 10^{-4} to 1 x 10^{-3}.

> **As Low As Reasonably Achievable**
>
> DOE regulations define ALARA as "the approach to radiation protection to manage and control exposures (both individual and collective) to the work force and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations" (10 CFR 835.2(a)). ALARA is not a dose limit but a process which has the objective of attaining doses as far below applicable limits as is reasonably achievable. All DOE activities are subject to the ALARA principle (10 CFR 835.101(c)). The ALARA principle is incorporated into DOE Order 5400.5, *Radiation Protection of the Public and the Environment*.

In addition, DOE is required to act such that radiation doses from its activities, including cleanup activities, are kept "as low as reasonably achievable" (ALARA), taking into account economic and other factors (*see* 10 CFR 835.101(c)). Application of the ALARA principle means that radiation doses for both workers and the public are typically kept lower than their regulatory limits (for example, below 15 millirem per year). Although DOE believes that the lifetime risk of a latent cancer fatality from residual contamination at ETEC would be well below 3 x 10^{-4} after completion of soil remediation and application of the ALARA principle, DOE is taking no credit for the expected reduction in risk in its analysis of the alternatives.[5]

3.2.1.2 Building 4059

This building was used for development testing of Space Nuclear Auxiliary Power reactors. It has two concrete-shielded vaults in the basement, only one of which housed a reactor. The reactor vault was made radioactive by neutron activation during Space Nuclear Auxiliary Power reactor tests. The above-grade portion of Building 4059 and portions of the basement were decontaminated and final surveys (including verification surveys of the above-grade structure and sampling by the Department of Health Services, EPA and the Oak Ridge Institute for Science and Education) completed in 1999.

Decontamination and Demolition

All equipment, piping, and tanks in Building 4059 have been removed and surface decontamination has been completed. The building may contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste.

The entire building (and Building 4459, located within the fenceline of Building 4059) would be surveyed and demolished in two phases. In the first phase, DOE would remove all clean portions of the building and would dispose of it in a local municipal sanitary landfill. In the second phase, DOE would remove the activated concrete in the pipe chase room, vacuum equipment room, and the north and south test vaults. DOE would package this material as LLW and ship it to DOE approved sites for disposal. The building would be demolished and the resulting nonhazardous debris would be removed for disposal.

Soil Remediation

After demolition of the building and removal of the debris, the remaining soil would be sampled. If any soil exceeded the 3 x 10^{-4} standard, it would be excavated and disposed of as LLW at an appropriate off-site disposal facility. However, based on initial surface soil sampling data, DOE does not expect that soil

[5] Prior remediation surveys at ETEC have demonstrated a residual risk in the 1 x 10^{-4} to 1 x 10^{-6} range.

remediation would be required for the area around Building 4059 to achieve the remediation goal for Area IV of the SSFL under Alternative 1. Following verification sampling by the Department of Health Services and the Oak Ridge Institute for Science and Education, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.1.3 Building 4024

This facility consists of two concrete-shielded underground vaults that housed the test reactors, an above-grade high bay support area, a control room, and engineering and administrative support offices. As in Building 4059, the reactor vaults were made radioactive by neutron activation during Space Nuclear Auxiliary Power reactor tests. The shielding concrete in the vaults contains low levels of activation products. Nine equipment storage vaults in the test cell corridor were used to store various pieces of contaminated equipment. A paved yard surrounds the facility where radioactive solid, liquid, and gas storage tanks were once buried but have since been removed.

Decontamination and Demolition

Similar to Building 4059, all equipment, piping and tanks in Building 4024 have been removed and surface decontamination has been completed. The building may contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste.

The entire building would be surveyed and demolished in two phases. The first phase would remove all uncontaminated debris and dispose of it in a local municipal sanitary landfill. In the second phase, DOE would remove the contaminated portions of the vaults, package the waste as LLW, and ship it to DOE sites for disposal. The building would be demolished and the resulting nonhazardous debris would be removed for disposal.

Soil Remediation

After demolition of the building and removal of the debris, the remaining soil would be sampled. If any soil exceeded the 3×10^{-4} standard, it would be excavated and shipped as LLW to an appropriate offsite disposal facility. However, based on limited surface soil sampling data, DOE does not believe that soil remediation would be required for the area around Building 4024 to achieve the remediation goal for Area IV of the SSFL under Alternative 1. Following verification sampling by the Department of Health Services and the Oak Ridge Institute for Science and Education, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.2 Closure and Demolition of the Sodium Pump Test Facility

With DOE authorization, Rocketdyne had been using this facility under a commercial contract to perform electromagnetic pump testing of sodium. This project was completed in late 2001. No radioactive materials were ever used at this facility.

Closure of the SPTF would begin by removing approximately 197,000 liters (52,000 gallons) of bulk sodium from the facility. As with the closure of other sodium buildings, the entire SPTF sodium system and all residual material contained within that system would be classified as “excluded recyclable material” under the California Health and Safety Code. As such, at least 75 percent of the sodium would need to be reused each year. To accomplish this, the sodium would be transferred to a new owner, who would provide transport vessels (receiving tanks) to receive and transport the sodium offsite. DOE would build a system to transfer the sodium from the existing facility sodium drain tanks to the new owner’s vessels. This system would be similar to the one designed, built, and operated for the transfer of sodium from the Sodium Component Test Installation. The sodium would be allowed to cool by means of heat loss through the vessel's insulation to the surrounding atmosphere and would become solid. The new owner would then transport the solid sodium offsite for reuse.

After the bulk sodium was removed, a sodium heel and a thin film of sodium would remain in the sodium pump tank. Sodium would also remain within the pipe system components. Because this remaining sodium cannot be easily removed and reused (as sodium metal), it would be converted into sodium hydroxide and reused. As with the decontamination of the Sodium Component Test Installation, DOE would use a variation of a water-vapor-nitrogen technique to convert the sodium into sodium hydroxide. In this process, subsaturated water vapor carried within a nitrogen steam would be introduced to the sodium. The water would react with the sodium in a controlled manner and produce sodium hydroxide that would be reused offsite.

All of the sodium components and piping would be cleaned to remove the residual sodium. The components would be either (1) size-reduced and cleaned in batches in a reaction chamber; (2) modified, sealed, and moved to the cleaning facility and cleaned as a unit; or (3) prepared and set up for cleaning and cleaned in place. DOE would then perform tests or examine the cleaned piping to verify the removal of the sodium. The remaining metal of the cleaned component would be collected and sent to scrap dealers for recycling.

The SPTF may also contain hazardous materials such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases. These would be removed and recycled or disposed of as hazardous waste. After demolition of the building and removal of the debris, the area would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area. Since the SPTF is not a radiological facility, no radiological release activities would occur.

3.2.3 Demolition of All Remaining Uncontaminated DOE Support Facilities

Approximately 50 other buildings on the ETEC site are uncontaminated support facilities. These facilities include sodium facilities from which the sodium has already been removed and three former radiological facilities that have been released, or are pending release, by DOE (with the concurrence of the California Department of Health Services) but not yet demolished. For purposes of analysis, DOE assumed that all of these buildings would be demolished. However, DOE may abandon a few of these buildings and turn them over to Rocketdyne for reuse.

After removal of any hazardous material such as lead-based paint, asbestos insulation, light fixture ballasts containing PCBs, solvents, oils, and greases, DOE would remove other components, segregate materials, and either recycle or dispose of the materials in a local municipal sanitary landfill. Following the demolition of the buildings and removal of the debris, the areas around the buildings would be backfilled with clean soil from an onsite borrow pit and resurfaced or revegetated to match the surrounding area.

3.2.4 Transportation

Implementation of Alternative 1 would involve the offsite truck transportation of LLW, MLLW, hazardous waste, and nonhazardous debris waste generated as a result of decontamination and demolition activities. TRU waste currently stored onsite would also be shipped offsite. Sodium would be shipped offsite for reuse.

LLW would be shipped to Nevada Test Site; MLLW would be shipped to Envirocare; hazardous waste would be shipped to a licensed hazardous waste disposal site, and nonhazardous debris waste would be shipped to a local municipal sanitary landfill. TRU waste would be shipped to WIPP for disposal. Table 3-2 shows the waste shipments that would be required under Alternative 1.

Table 3-2. Offsite Shipments Under Alternative 1

Waste Type	Number of Truck Shipments
LLW	553[a]
MLLW	20
TRU Waste	5
Hazardous Waste	5
Nonhazardous Debris Waste	1,860[a]
Sodium	11[b]

a. The number of truck shipments was calculated by dividing the total volume to be shipped by 13.6, the volume assumed that could be loaded onto one truck.
b. Approximately 18,900 liters (5,000 gallons) of sodium can be transported in one truck shipment. Shipment of 197,000 liters (52,000 gallons) would require 11 shipments.

In addition, there would be approximately 400 truck shipments of clean soil from the onsite borrow area to the RMHF.

3.3 ALTERNATIVE 2: CLEANUP AND CLOSURE USING A 1 X 10^{-6} RISK STANDARD

Implementation of Alternative 2 would involve the same actions described under Alternative 1. However, under Alternative 2, the soil remediation goal for Area IV would be an additional theoretical lifetime risk of a latent cancer fatality to the maximally exposed individual of no greater than 1 x 10^{-6} as a result of exposure to the radiological contamination remaining on the site. Using this standard, the maximally exposed individual would receive no more than a 0.05-millirem radiation dose each year due to exposure to residual radiological contamination at ETEC. For perspective, it is estimated that the average individual in the United States receives a dose of about 300 millirem each year from natural sources of radiation.

Implementation of Alternative 2 would require more soil remediation at the RMHF than would be required under Alternative 1. Unlike Alternative 1, Alternative 2 would also require soil remediation at Building 4024. Because DOE has remediated soils around former ETEC radiological facilities to a 3 x 10^{-4} additional lifetime risk level, implementation of Alternative 2 would also require additional soil remediation at the former ETEC radiological facilities at Area IV. The additional soil remediation (excavation) required under Alternative 2 would take an additional 3 years to complete, as compared to Alternative 1, assuming the same level of effort.

Under Alternative 2, approximately 404,850 cubic meters (14.3 million cubic feet) of soil would need to be excavated in order to meet the remediation goal of an additional 1 x 10^{-6} theoretical lifetime cancer risk as a result of radiological contamination remaining on Area IV as a whole. Table 3-3 indicates the total volumes of radioactive, hazardous, and nonhazardous debris waste that would be generated under Alternative 2. Only the volume of LLW differs between Alternatives 1 and 2.

Table 3-3. Waste Volumes Generated Under Alternative 2

Waste Type	Waste Volume (cubic meters)[a]
Low-Level Radioactive Waste	**406,850**
Building Decontamination	2,000
Soil Remediation (1 x 10^{-6} Standard)	404,850
• RMHF	27,500
• Building 4059	None expected
• Building 4024	9,350
• Remainder of Area IV	368,000
Mixed Low-level Radioactive Waste	**20**
Hazardous Waste	**5**
Nonhazardous Debris Waste (Uncontaminated)	**25,300**

a. To convert cubic meters to cubic feet, multiply by 35.3.

Similar to Alternative 1, the volume of soil that would need to be remediated in the implementation of Alternative 2 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 290 acres of Area IV and soil samples taken at RMHF during 2000. The 149 soil samples taken were assumed to be characteristic of surface soil on Area IV. These soil samples provide a distribution of cesium-137, the primary contaminant of concern (as explained more fully in Chapter 4). Conservatively assuming that these predominantly surface samples are representative of all Area IV soil down to bedrock, DOE estimated the volume of soil that would need to be excavated to meet the 1 x 10^{-6} additional lifetime cancer risk (0.05-millirem annual dose) standard. Based on this dataset, DOE calculated that soil remediation would be required for the RMHF, Building 4024, and the remainder of Area IV. For the remainder of Area IV, DOE assumed that 817,600 square meters (200 acres) of Area IV are soil-covered and habitable and that the average soil depth is 3 meters (10 feet). Because the 1995 data show that approximately 15 percent of Area IV may contain radiological contamination in excess of the 1 x 10^{-6} goal, approximately 368,000 cubic meters (13 million cubic feet) of soil would need to be excavated. All excavated soil would be managed as LLW.

After a verification survey confirmed that the remediation goal was met, the area would be backfilled with clean soil and resurfaced or revegetated to match the surrounding area.

Implementation of Alternative 2 would involve the same type of offsite truck transportation of radioactive, hazardous, and nonhazardous debris waste for disposal and sodium for reuse. With the exception of LLW, the number of shipments required would be the same under Alternatives 1 and 2. Table 3-4 shows the truck shipments that would be required under Alternative 2.

Because there would not be sufficient clean soil available from the onsite borrow area[6], most of the clean soil would be trucked in from an offsite borrow area. Thus, implementation of this alternative would also require the shipment of approximately 26,000 truckloads of 354,390 cubic meters (12.5 million cubic feet) of clean soil to the site.

6 As noted above, only 50,460 cubic meters (1.8 million cubic feet) of clean soil are available from the onsite borrow area for all SSFL environmental projects. Because 404,850 cubic meters (14.3 million cubic feet) of clean soil would be needed, at least 354,390 (12.5 million cubic feet) would need to be brought in from offsite.

Table 3-4. Offsite Shipments Under Alternative 2

Waste Type	Number of Truck Shipments
LLW	30,000[a]
MLLW	20
TRU Waste	5
Hazardous Waste	5
Nonhazardous Debris Waste	1,860[a]
Sodium	11[b]

a. The number of truck shipments was calculated by dividing the total volume to be shipped by 13.6, the volume assumed that could be loaded onto one truck.

b. Approximately 18,900 liters (5,000 gallons) of sodium can be transported in one truck shipment. Shipment of 197,000 liters (52,000 gallons) would require 11 shipments.

3.4 NO ACTION ALTERNATIVE: NO FURTHER CLEANUP AND SECURE THE SITE

Under the No Action Alternative, DOE would conduct no further cleanup of ETEC facilities or soil. DOE would implement the following institutional controls to protect the public:

- Facility surveillance and maintenance programs would be designed to ensure structural stability, prevent releases of contamination, and safely store any remaining radioactive or hazardous materials.

- Access to groundwater or surface water contamination would be prohibited for the public and controlled for industrial workers. Access to facilities and soil would be prohibited for the public and controlled for industrial workers to reduce exposure and risk.

- Groundwater pump-and-treat activities would continue at the current level of effort, or other mitigation actions, approved by the California Department of Toxic Substances Control, would be taken until there is evidence, verified by the Department, that offsite migration of contaminants in groundwater was no longer possible.

- Maintenance of sediment controls to prevent migration of chemical contaminants in surface water would continue until there was evidence, verified by the Regional Water Quality Control Board, that offsite migration of chemical contaminants in surface water was no longer possible.

All contaminated and uncontaminated structures would remain in place. None of the radiological or hazardous contamination remaining in or near the facilities would be removed from the facilities or the site. No radiologically contaminated soil would be removed from Area IV.

The No Action Alternative is presented as a baseline against which the potential impacts of Alternatives 1 and 2 can be compared (*see* 40 CFR 1502.14(d)). This alternative is intended to present the minimum requirements that would protect human health and the environment in the event that more extensive remediation cannot be performed (for example, if adequate funding for remedial actions is not approved by the U.S. Congress or by DOE). However, as noted in Chapter 1, DOE recognizes its responsibility for the remaining radioactive and chemical contamination at ETEC and is proposing to clean up the site prior to closure. DOE will use this EA, and other appropriate information, to decide the most appropriate cleanup and closure procedure for the radiological contamination and hazardous materials remaining at ETEC, such as sodium.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED

The following alternatives were considered but were eliminated from further study because of technical or jurisdictional considerations.

3.5.1 Clean Up SSFL

During the public scoping process, a commentor suggested that DOE should consider cleaning up the entire SSFL site, rather than limiting its activities to ETEC facilities. DOE did not analyze this alternative because DOE does not have jurisdiction over the SSFL and is not responsible for contamination other than that which occurred as a result of DOE activities. Therefore, evaluation of ongoing cleanup outside of ETEC and Area IV is beyond the scope of this EA. Cleanup of contamination resulting from DOE-sponsored activities that has migrated outside of the ETEC facility area is within the scope and is addressed in this EA. It should be noted, however, that cleanup of the other areas of SSFL is being performed pursuant to applicable laws and regulations in coordination with appropriate regulatory agencies.

3.5.2 Dispose of All Waste as LLW

An EPA comment on the scoping for this EA (*see* Appendix A) suggested that DOE consider an alternative under which all of the radiologically contaminated buildings would be disposed of as radioactive waste, "rather than surveying, sampling, decontaminating, and repeating."

DOE did not evaluate this alternative for the following reasons. Even if all generated waste were assumed to be radiologically contaminated, waste streams sent to an LLW or MLLW facility would still have to be sampled and analyzed to ensure that the facility's waste acceptance criteria were met. Therefore, there would be no cost savings for reduced characterization requirements. Once sampling and analysis was complete, the additional cost to segregate waste streams would be minimal. Segregating the waste also provides opportunities for reuse or recycling some of the uncontaminated building materials subject to DOE approval. In addition, the capacity in existing LLW and MLLW disposal facilities is limited; disposing of large volumes of clean material along with the contaminated portions of building debris would unnecessarily reduce the remaining capacity of these facilities. This could possibly create the need for siting and constructing a new LLW or MLLW landfill. Finally, this alternative would not be consistent with existing policies regarding waste minimization. For these reasons, this alternative was eliminated from further study.

3.5.3 Clean Up to Industrial Standards

The site is currently an industrial site and is expected to remain so for the immediate future. It would be reasonable to consider an alternative that uses an industrial worker scenario to evaluate exposure pathways and durations. Compared to residential exposure, industrial worker exposure is typically for fewer hours per day, fewer days per year, and fewer years at the site. Exposure pathways such as inhalation of volatile contaminants while showering using a contaminated groundwater source are eliminated. Exposure of children is eliminated. For these reasons, an industrial worker can be exposed to much higher contaminant concentrations than a residential receptor before the calculated risk becomes unacceptable.

Most of the site has already been cleaned up to residential levels. Cleanup of remaining contamination to residential levels would ensure that industrial receptors would also be protected. For these reasons, this alternative was eliminated from further study.

3.5.4 Clean Up to Background Levels

DOE considered whether it would be technologically and economically practicable to remove any trace of detectable contamination resulting from operations at ETEC. However, because background levels of radiological and chemical constituents in soil vary widely locally, regionally, nationally, and worldwide, there are technical questions regarding determination of background levels. In addition, due to the detection limits of current field survey, sampling, and analysis technology, it is difficult or impossible to detect a small fractional increment of contamination above background levels.

The only way to ensure that cleanup to background levels was accomplished would be to remove all soil on the site down to bedrock and replace it with clean backfill. The removed soil would have to be transported to an appropriate disposal site, which could result in transportation accidents and fatalities. On the other hand, the reduction in expected latent cancer fatalities compared to residential cleanup levels would be almost imperceptible. Because remediation to background levels would be impracticable and the additional reduction in risk compared to the alternatives considered would be negligible, this alternative was eliminated from further study. DOE did analyze an alternative that would reduce the additional lifetime cancer risk of the maximally exposed individual to 1×10^{-6}, which is very close to background.

3.6 SUMMARY OF IMPACTS

Under both Alternative 1 and Alternative 2, DOE would decontaminate, decommission, and demolish radiological facilities and soil surrounding these facilities. Under Alternative 1, DOE would conduct soil remediation activities until a risk level of 3×10^{-4} was attained. Under Alternative 2, DOE would conduct soil remediation activities until a risk level of 1×10^{-6} was attained.

DOE would also decommission and demolish the remaining sodium facility, after removing the sodium for reuse. Radioactive and hazardous waste would be shipped offsite for disposal; the sodium would be transported offsite for reuse.

The only difference between Alternative 1 (DOE's preferred alternative) and Alternative 2 is the volume of soil that would need to be excavated and shipped offsite. Approximately 70 times more soil would be excavated under Alternative 2 as compared to Alternative 1.

Because soil remediation activities (excavation) require heavy physical labor and use of power equipment, this work can result in industrial hazards such as trips and falls, equipment accidents, tool mishandling, and dropped loads. The incidence of these hazards increases as the number of worker hours increases and can be calculated using standard industrial accident rates (fatalities per worker year).

In addition, decontamination and decommissioning activities require the shipment of materials over public highways, which can result in traffic accidents and fatalities. As with industrial hazards, fatalities due to transportation accidents can be calculated using standard traffic accident rates (fatalities per kilometer traveled). The incidence of traffic accidents, and the potential for fatalities due to traffic accidents, increases as the number of shipments and distances traveled increases.

The implementation of Alternative 2 would require substantially more soil remediation (excavation of approximately 404,850 cubic meters of soil as compared to 5,550 cubic meters of soil under Alternative 1) and transportation (approximately 30,000 shipments of contaminated soil offsite and 26,000 shipments of clean soil to the site for revegetation compared to 553 shipments under Alternative 1) than would Alternative 1. This additional soil remediation and resulting transportation is likely to result in increased worker and public fatalities, as compared to Alternative 1.

Against this projection of fatalities due to industrial hazards and transportation accidents must be balanced the reduction in risk due to the reduction in radiation exposure. Under Alternative 1, the expected latent cancer fatalities in a population of 500 people living on the ETEC site following remediation to the 3×10^{-4} theoretical lifetime cancer risk standard (not taking ALARA into account) would be 0.15 as a result of residual radiological contamination. Under Alternative 2, the expected latent cancer fatalities in a population of 500 people living on the ETEC site following remediation to the 1×10^{-6} theoretical lifetime cancer risk standard would be 5×10^{-4} as a result of residual contamination. The individual lifetime risk of incurring any cancer from all causes is approximately 0.23 (*Cancer Journal for Clinicians,* Cancer Statistics, 2001) (1998 data). Thus, the cumulative individual risk of incurring cancer from all causes plus the individual risk of incurring cancer as a result of exposure to residual radiological contamination on Area IV would be 0.2303 for Alternative 1, 0.230001 for Alternative 2, and 0.2317 for the No Action Alternative.

A summary of the impacts that could occur for the alternatives analyzed is contained in Table 3-5.

Table 3-5. Summary of Impacts

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
LAND USE (see Section 4.1)		Residential use	Residential use	Industrial use
GEOLOGY AND SOILS (see Section 4.2)	Residual contamination (40-year exposure)	3×10^{-4} additional lifetime cancer risk	1×10^{-6} additional lifetime cancer risk	1.7×10^{-3} additional lifetime cancer risk
AIR QUALITY (see Section 4.3)				
Criteria air pollutants		No exceedances expected	No exceedances expected	No exceedances expected
WATER QUALITY AND WATER RESOURCES (see Section 4.4)				
Groundwater		No impact expected	No impact expected	No impact expected
Surface water		No impact expected	No impact expected	No impact expected
Wetlands		No impact expected	No impact expected	No impact expected
Floodplains		No impact expected	No impact expected	No impact expected
RADIOLOGICAL DOSE (see Section 4.5)				
Public				
Maximally exposed individual - annual	Millirem	2.8×10^{-3}	2.8×10^{-3}	7.7×10^{-7}
Maximally exposed individual - total	Millirem	1.4×10^{-2}	2.2×10^{-2}	Not applicable
Population – annual	Person-rem	0.11	0.11	2.2×10^{-4}
Population – total	Person-rem	0.56	0.9	Not applicable
Worker				
Average - annual	Millirem	470	470	7
Average - total	Millirem	2,345	3,760	Not applicable
Population – annual	Person-rem	10.3	10.3	0.92
Population – total	Person-rem	52	82	Not applicable

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
HUMAN HEALTH (see Section 4.5)				
Public				
Maximally exposed individual - annual	Probability of latent cancer fatality	1.4×10^{-9}	1.4×10^{-9}	3.9×10^{-13}
Maximally exposed individual - total	Probability of latent cancer fatality	7.0×10^{-9}	1.1×10^{-8}	Not applicable
Population – annual	Latent cancer fatality	5.6×10^{-5}	5.6×10^{-5}	1.1×10^{-7}
Population – total	Latent cancer fatality	2.8×10^{-4}	4.5×10^{-4}	Not applicable
Residual risk following remediation				
Individual living onsite for 40 years	Probability of latent cancer fatality	3×10^{-4}	1×10^{-6}	1.7×10^{-3}
Population (500 people living onsite for 40 years)	Latent cancer fatality	0.15	5×10^{-4}	0.85
Total cancer risk (all causes)[a]	Probability of latent cancer fatality	0.230300	0.230001	0.2317
Worker				
Average - annual	Probability of latent cancer fatality	1.9×10^{-4}	1.9×10^{-4}	2.8×10^{-6}
Average - total	Probability of latent cancer fatality	9.4×10^{-4}	1.5×10^{-3}	Not applicable
Population – annual	Latent cancer fatality	4.1×10^{-3}	4.1×10^{-3}	3.7×10^{-4}
Population – total	Latent cancer fatality	2.1×10^{-2}	3.3×10^{-2}	Not applicable

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
Facility Accidents				
Industrial (workers)	Fatalities per year	5.2×10^{-3}	6.5×10^{-3}	1.8×10^{-3} (1st year) 1.3×10^{-3} (subsequent years)
Radiological				
Public – maximally exposed individual	Probability of latent cancer fatality	3.5×10^{-6}	3.5×10^{-6}	0
Public - population	Probability of latent cancer fatality	0.5	0.5	0
Worker (100 meters away)	Probability of latent cancer fatality	7.0×10^{-4}	7.0×10^{-4}	0
Sodium		Injury and death could occur in worker population	Injury and death could occur in worker population	None
BIOLOGICAL RESOURCES (see Section 4.6)				
Threatened/endangered/sensitive species		No impact expected	Potential impact	No impact expected
Other plants and animals		No impact expected	No impact expected	No impact expected
CULTURAL RESOURCES (see Section 4.7)		No impact expected	Potential impact	No impact expected
NOISE AND AESTHETICS (see Section 4.8)		No impact expected	Potential impact	No impact expected
SOCIOECONOMICS (see Section 4.9)		No impact expected	No impact expected	No impact expected
WASTE MANAGEMENT (see Section 4.10)				
LLW generated	Cubic meters	7,500	406,850	0
MLLW generated	Cubic meters	20	20	0
TRU waste generated	Cubic meters	0	0	0
Hazardous waste generated	Cubic meters	5	5	0
Nonhazardous debris waste generated	Cubic meters	25,300	25,300	0

Table 3-5. Summary of Impacts (cont)

Resource	Unit of Measure	Alternative 1 (5 years) *Preferred Alternative*	Alternative 2 (8 years)	No Action Alternative (Perpetuity)
TRANSPORTATION (see Section 4.11)				
LLW shipments	Number of truck shipments	553	30,000	0
MLLW shipments	Number of truck shipments	20	20	0
TRU waste shipments	Number of truck shipments	5	5	0
Hazardous waste shipments	Number of truck shipments	5	5	0
Nonhazardous debris waste shipments	Number of truck shipments	1,860	1,860	0
Sodium shipments	Number of truck shipments	11	11	0
Clean backfill shipments	Number of truck shipments	0	26,000	0
Transportation accidents (nonradiological)				
LLW shipments	Fatalities	2.5×10^{-2}	1.4	0
Nonhazardous debris shipments	Fatalities	5.7×10^{-3}	5.7×10^{-3}	0
Emission exhaust (all shipments)	Fatalities	6.0×10^{-3}	0.23	0
ENVIRONMENTAL JUSTICE (see Section 4.12)		No impact expected	No impact expected	No impact expected

a. The lifetime cancer risk of incurring any cancer from all causes is approximately 0.23 (*Cancer Journal for Clinicians*, Cancer Statistics, 2001) (1998 data). This represents the cumulative risk of incurring cancer from all causes plus the risk of incurring cancer as a result of exposure to residual radiological contamination on Area IV.

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the resources that would be affected by implementation of the alternatives analyzed in this EA. For each resource, the EA describes the current conditions at the site and then discusses how those resources would be affected by the alternatives. The impacts of the transportation of nonhazardous solid waste and sodium (for reuse) are also addressed; however, as noted in Chapter 2, impacts that could occur as a result of transportation of radioactive and hazardous waste from ETEC to offsite disposal sites have been addressed in prior NEPA documents and will not be addressed further here (*see* Section 2.4). In addition, this chapter discusses the potential cumulative impacts of the cleanup activities proposed and analyzed in this EA and other ongoing or future site activities, including the cleanup of chemical contamination under RCRA.

4.1 LAND USE

4.1.1 Current Conditions

The ETEC complex of buildings is located on approximately 364,000 square meters (90 acres) within Area IV of the SSFL. Figure 4-1 shows the SSFL arrangement.

Undeveloped land surrounds most of the SSFL site. No significant agricultural land use, including prime or unique farmland, exists within 30 kilometers (19 miles) of the site. The location of the SSFL site in relation to nearby communities is shown in Figure 4-2. The community of Santa Susana Knolls lies 5 kilometers (3 miles) to the northeast of Area IV. The Bell Canyon area begins approximately 2.3 kilometers (1.4 miles) to the southeast, and the Brandeis-Bardin Institute is adjacent to the north. The closest residential portion of Simi Valley is 2.7 kilometers (1.7 miles) northwest of Area IV. The Santa Monica Mountains National Recreation Area, Malibu Creek State Park, and Topanga Canyon State Park are within 16 kilometers (10 miles) of the center of the SSFL, as are several state beaches; the Channel Islands National Park, Los Padres National Forest, Point Mugu State Park, Leo Carrillo State Park, Will Rogers State Historical Park, and additional state beaches are within 80 kilometers (50 miles) of the center of the SSFL. There are no wild and scenic rivers on or near the SSFL.

4.1.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would not affect current land uses at the site. Cleanup of Area IV to the DOE standard (3×10^{-4} residual risk or 15-millirem annual dose) would allow future residential use of the site. There would be no impacts to prime or unique farmland, state or national parks, or wild and scenic rivers.

4.1.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1×10^{-6} Risk Standard)

Implementation of Alternative 2 would not affect current land uses at the site. Cleanup of Area IV to the designated risk standard (1×10^{-6} residual risk or 0.05-millirem annual dose) would allow future residential use of the site. There would be no impacts to prime or unique farmland, state or national parks, or wild and scenic rivers.

Subdivisions			
Owner	**Jurisdiction**	**Acres**	**Subtotals**
Rocketdyne	Rocketdyne-Area IV	289.9	
	Rocketdyne	784.8	
	Rocketdyne (Undeveloped land)	1,324.6	2,399.3
Government	NASA (former AFP 57)	409.5	
	NASA (former AFP 64)	41.7	451.2
Total Acres			2,850.5

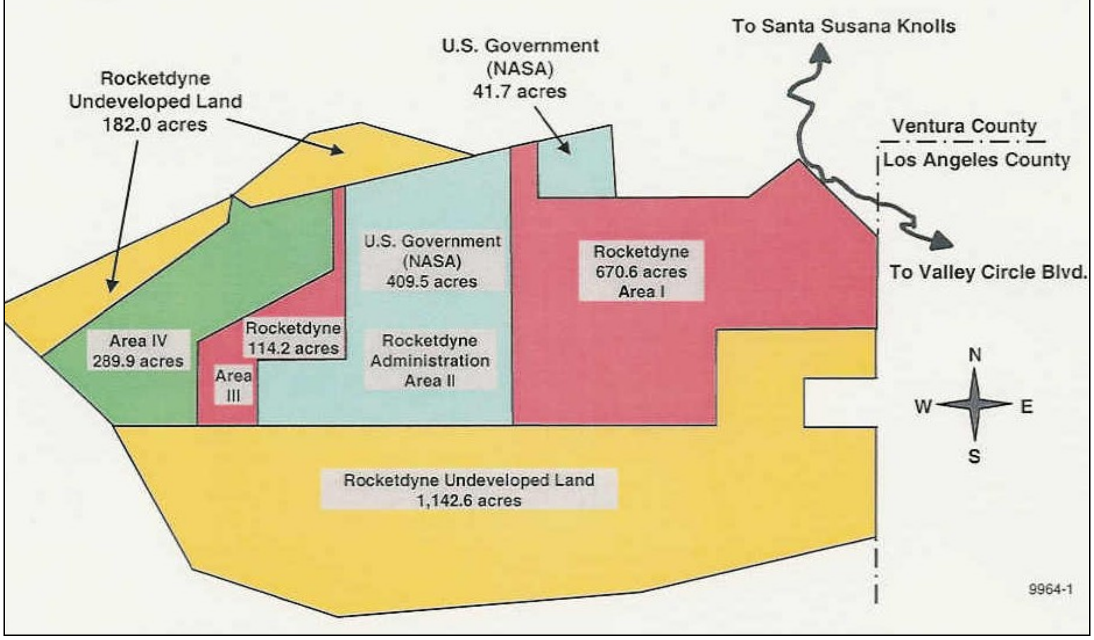

Figure 4-1. SSFL Arrangement

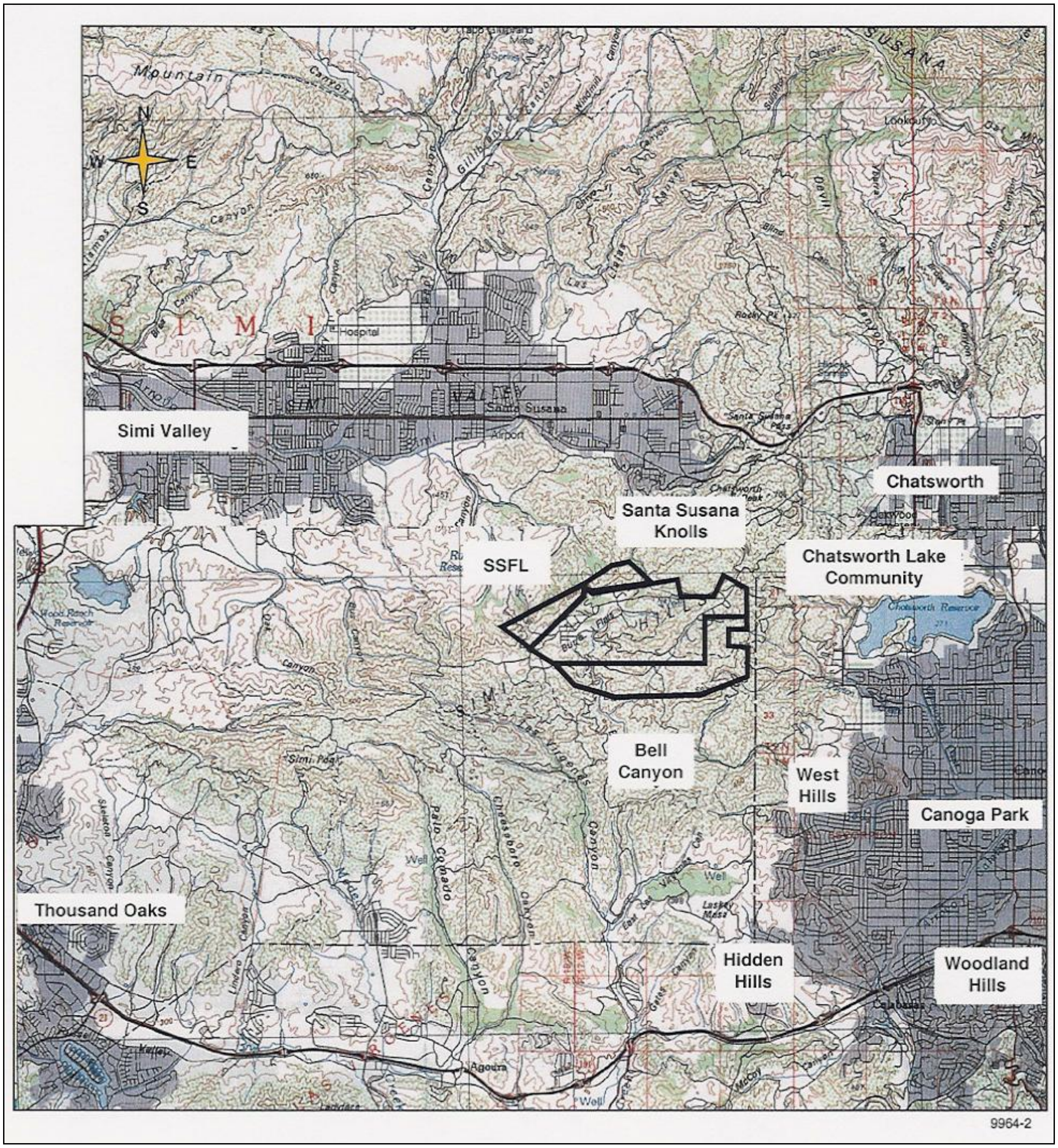

Figure 4-2. SSFL Location in Relation to Nearby Communities

4.1.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect current land uses at the site. However, the site would not be available for any other purposes in perpetuity or until such time as residual radioactive contamination fell within acceptable standards.

4.2 GEOLOGY AND SOILS

4.2.1 Current Conditions

The SSFL is part of the Chatsworth Formation, which is composed of poorly to well-cemented massive sandstone with interbeds of siltstone and claystone. It is situated on rocky terrain and occupies an upland area known as Burro Flats, which sits at the crest of the Simi Hills, near their eastern end. Area IV is between 570 meters (1,880 feet) and 660 meters (2,150 feet) above sea level and is relatively flat. Its overlying soils consist of weathered bedrock and alluvium (unconsolidated sand, silt, and clay materials that have been eroded primarily from the surrounding Chatsworth and Martinez Formations). Several geologic faults transverse the site.

Radiological Contamination. Soil radioactivity at ETEC is due to various naturally occurring radionuclides present in the environment, radioactive fallout of dispersed nuclear weapons materials from offsite locations, and nuclear reactor and other operations in ETEC facilities. The radionuclide composition of local area surface soil has been determined to be predominantly potassium-40, natural thorium, natural uranium, and their decay progeny. Radioactivity in the soil from nuclear weapons test fallout consists primarily of strontium-90, cesium-137, and plutonium-239. In soil sampling done in 2000, only trace amounts of cesium-137 (a man-made radionuclide) were detected, in addition to naturally occurring potassium-40 and uranium and thorium decay products. The maximum observed cesium-137 concentration was 53 picocuries/gram from one soil sample taken near the RMHF in 2000 (the highest concentration of cesium-137 in soil samples taken from other locations on Area IV in 1995 was 2.4 picocuries/gram). An individual who was exposed to this level of contamination in a residential lot, to a depth of 1 meter (3.3 feet) for 40 years would experience an additional theoretical lifetime cancer risk of 1.7×10^{-3}.[7]

> **Potassium-40**
>
> Potassium-40 is a naturally occurring radionuclide present at the site. It is not a regulated material. Soil sampling conducted by DOE in and around ETEC has not found any significant difference between the concentration of potassium-40 in onsite and offsite samples.

Chemical Contamination. The RCRA Facility Investigation Program started at the SSFL in 1996 and is ongoing. The primary objectives of the program are to (1) investigate the nature and extent of chemicals in the soil and the potential threat to groundwater, and (2) evaluate the potential risk to human health and the environment and assess whether remediation is required. Soil sampling conducted for the RCRA Facility Investigation Program revealed areas on the SSFL with elevated levels of petrochemicals (diesel fuel, lubricants, oil, and grease), solvents, metals, and other chemicals. All remediation of chemical contamination on the SSFL, including ETEC, will be conducted under the RCRA process and is not analyzed in this EA.

[7] Naturally occurring radionuclides in clean soil result in an annual exposure to individuals of between 30 and 50 millirem. This results in an annual theoretical fatal cancer risk of 6×10^{-4} to 1×10^{-3}.

4.2.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would reduce radiological contamination in the soil such that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 3×10^{-4} to the maximally exposed individual. This additional lifetime cancer risk would result from exposure to no more than a 15-millirem radiation dose annually to the maximally exposed individual. Alternative 1 would have no impact on the general terrain because the area would be regraded with clean soil from the onsite borrow area.

4.2.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1×10^{-6} Risk Standard)

Implementation of Alternative 2 would reduce radiological contamination in the soil such that any remaining radiological contamination would result in an additional theoretical lifetime cancer risk of no more than 1×10^{-6} to the maximally exposed individual. This additional lifetime cancer risk would result from exposure to no more than a 0.05-millirem radiation dose annually to the maximally exposed individual. Similar to Alternative 1, implementation of Alternative 2 would require excavation of soil on Area IV, but the volume of soil would be much greater. Because the area would be regraded with clean soil from off the site, implementation of Alternative 2 would have no impact on the general terrain.

4.2.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would leave existing radiological contamination in place. An individual who was exposed for 40 years to the highest level of contamination found on Area IV would experience an additional theoretical lifetime cancer risk of 1.7×10^{-3}.

4.3 AIR QUALITY

4.3.1 Current Conditions

In compliance with the Clean Air Act, 42 U.S.C. 7401 *et seq*., the EPA has promulgated National Primary and Secondary Ambient Air Quality Standards for six air pollutants that are responsible for most air pollution (40 CFR Part 50). These are known as criteria air pollutants. They are carbon monoxide, sulfur dioxide, particulate matter, ozone, nitrogen oxide, and lead.

Air pollutant discharge limitations at the SSFL are imposed by the Ventura County Air Pollution Control District rules and regulations and a Permit to Operate, which is kept current and renewed each year by the district. ETEC does not emit lead, and all other emissions of criteria air pollutants at the SSFL are below applicable permit limits.

Further, EPA has promulgated regulations for hazardous air pollutants and has established a 10-millirem dose limit per year from airborne releases of radionuclides (40 CFR Part 61, Subpart H). The ETEC radiological monitoring program measures radioactive emissions from point sources (emission stacks). At the end of each year, the air samples for the entire year are combined and analyzed for specific radionuclides. The results are used to estimate the potential offsite dose to the maximally exposed member of the public from the air pathway. Table 4-1 shows the results of the air emissions monitoring at ETEC for the last 5 years. Potential health impacts from the radioactive air emissions are addressed in Section 4.5. DOE implements mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway.

Table 4-1. Results of Radioactive Air Emissions Monitoring, 1996 – 2000

Year	Annual Radiation Dose to Maximally Exposed Individual – Air Pathway (Point Sources)[a]	Annual Radiation Dose to Maximally Exposed Individual – Air Pathway (Area Sources)[b]	Average Annual Background Radiation Dose to an Individual (All Sources)	Annual Population Dose[c] – Air Pathway (Point Sources)	Annual Population Dose[c] – Air Pathway (Area Sources)	Average Annual Population Dose Resulting from Background Radiation (All Sources)
1996	4.6×10^{-6} millirem	1.3×10^{-4} millirem	300 millirem	6.4×10^{-3} person-rem	5.1×10^{-3} person-rem	3 million person-rem
1997	2.7×10^{-6} millirem	1.6×10^{-4} millirem	300 millirem	6.8×10^{-4} person-rem	6.2×10^{-3} person-rem	3 million person-rem
1998	1.3×10^{-6} millirem	2.5×10^{-3} millirem	300 millirem	2.9×10^{-4} person-rem	8.5×10^{-2} person-rem	3 million person-rem
1999	2.2×10^{-7} millirem	6.6×10^{-7} millirem	300 millirem	4.8 x 10-^{5} person-rem	4.7×10^{-5} person-rem	3 million person-rem
2000	7.7×10^{-7} millirem	None	300 millirem	2.2×10^{-4} person-rem	None	3 million person-rem

a. Point sources are monitored exhaust stacks from the Hot Laboratory (now decontaminated and demolished), Building 4024, and the RMHF. There is a 10-millirem-per-year dose limit on radionuclide air emissions from point sources. *See* 40 CFR Part 61, Subpart H.

b. Area sources at ETEC are sources of windborne resuspension of radioactively contaminated soil. These are the RMHF sump (when dry), Building 4064 Side Yard before remediation, Building 4020 yard soil before remediation, and the 17th Street Drainage Area site. The emissions from area sources cannot be measured and are estimated using conservative assumptions and a computer modeling calculation. Reporting this source is not a regulatory requirement.

c. Total dose to population within 80 kilometers (50 miles) of SSFL.

Sources: National Emission Standards for Hazardous Air Pollutants – Radionuclides Reports for 1996, 1997, 1998, 1999, 2000; 1996 Annual Site Environmental Report.

4.3.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would result in very slight increases in emissions of criteria air pollutants from the operation of machinery on the site for demolition and offsite transportation of waste. These emissions would be temporary, would not exceed any permit limits for the site, and would not affect air quality in the area or in the region.

Demolition and soil removal activities could also result in fugitive dust emissions. DOE would use dust suppression techniques such as spraying water to reduce fugitive dust emissions to the extent possible.

Radionuclide emissions could also increase slightly (see Section 4.5.2), but no higher than they have been in previous years when radiologically contaminated facilities were decontaminated and demolished. DOE would continue to implement mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway. Potential doses from the decontamination of the radiological facilities and soil under Alternative 1 are described below in Section 4.5, Human Health.

4.3.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Implementation of Alternative 2 would also result in very slight increases in emissions of criteria air pollutants from the operation of machinery on the site for demolition and offsite transportation of waste. These emissions would be temporary, would not exceed any permit limits for the site, and would not affect air quality in the area or in the region. Emissions of criteria air pollutants from the operation of machinery would continue for 3 years longer than under Alternative 1 because of the additional soil remediation that would occur under Alternative 2.

Demolition and soil removal activities could also result in fugitive dust emissions. DOE would use dust suppression techniques such as spraying water to reduce fugitive dust emissions to the extent possible. Because more soil would be removed under Alternative 2 than under Alternative 1, the potential for fugitive dust emissions and the level of those emissions would be greater under Alternative 2 than under Alternative 1.

Alternative 2 would result in annual radionuclide emissions similar to those under Alternative 1, but would continue for 3 years longer because of the additional soil remediation required. DOE would continue to implement mitigation measures such as dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway. Potential doses from the decontamination of the radiological facilities and soil under Alternative 2 are described below in Section 4.5, Human Health.

4.3.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in continued releases of radioactive air emissions at very low levels. In 2000, the total air emissions were 7.7 x 10^{-7} millirem (see Table 4-1).

4.4 WATER QUALITY AND WATER RESOURCES

4.4.1 Current Conditions

Water resources on the SSFL consist of (1) a shallow groundwater system that exists in the surficial alluvium at small, isolated locations, and (2) a deeper regional groundwater system in the fractured Chatsworth Formation. There are no natural surface waters on the site, although portions of the site become saturated during and immediately following the wet season in the winter months. Because of its elevation, Area IV is not within a floodplain.

Groundwater. Forty-seven wells in and around Area IV are used to monitor water levels and to monitor the condition of the groundwater (including concentrations of chemicals and/or radioactivity released by DOE operations). Past ETEC operations resulted in chemical and radiological contamination of groundwater. A Groundwater Monitoring Program has been established to detect the presence of volatile organic compounds, base/neutral and acid extractable organic compounds, petroleum hydrocarbons, trace metals and common ion constituents, and radiological constituents.

The major chemical groundwater contaminant at the site is TCE. TCE is a dense liquid that does not dissolve easily in water. Though it is not very soluble, TCE can dissolve somewhat in groundwater, and even at low concentrations can be toxic if ingested over a long period of time. This solution can be transported by groundwater through the fractured Chatsworth formation sandstone.

Groundwater remediation through pumping and treating has been under way since 1994 to reduce contamination in groundwater and prevent contamination plumes from migrating beyond site boundaries. Data have also been collected to refine the understanding of groundwater movement and contaminant migration and to evaluate possible continuing releases from historically contaminated soil and sediment.

Radioactivity concentrations in groundwater at SSFL are below drinking water standards. Laboratory analyses were performed for tritium in 43 water samples from 26 groundwater-monitoring wells. Of the 43 analyses performed, seven samples from four onsite wells had tritium concentrations higher than the detection limits. The maximum value among all the results was far below the EPA and California drinking water limit. No offsite wells show the presence of tritium. The occurrence of tritium in groundwater appears to have resulted from formation of tritium in the reactor shielding in Building 4010, which has been decontaminated, released for unrestricted use, and subsequently demolished. Prior to removal, tritiated water migrated from the concrete into the surrounding soil and subsequently into the groundwater.

Surface Water. Most of Area IV slopes toward the southeast. Rainfall runoff is collected by a series of drainage channels and accumulates in an onsite retention pond beyond the Area IV boundary. Influent to the retention pond includes tertiary treated domestic sewage, cooling water from various testing operations, and treated groundwater and stormwater runoff. Water from the pond is eventually released to Bell Creek (a tributary of the Los Angeles River) under an NPDES permit issued pursuant to the Clean Water Act, 33 U.S.C. 1251 *et seq*.

Some of Area IV slopes to the northwest, and a small amount of rainfall drains toward the northwest ravines, which lead into Meier Canyon. To permit sampling of this runoff, five catch basins were installed in 1989 near the site boundary to accumulate Area IV runoff from the northwest portion of the site.

DOE routinely monitors all water outfalls. Since 1989, this monitoring has found no indication of any radiological contamination of surface water discharges, and all monitoring results have been below the drinking water supplier limits established in the NPDES permit. Mercury, antimony, copper, and cadmium have been found at levels above acceptable guidelines. DOE has taken measures such as installing sediment control structures, replacing equipment, and cleaning an outside storage area to bring the levels of these chemicals to within permitted levels. Ultimately, the releases will be controlled by the restoration of the areas that are the source of the contamination.

Wetlands. Pursuant to Section 404 of the Clean Water Act, 33 U.S.C. 1344, the U.S. Army Corps of Engineers regulates the "discharge of dredged or fill material" into "waters of the United States," which includes tidal waters, interstate waters, and all other waters that are part of a tributary system to interstate waters or to navigable "waters of the United States." In addition, the California Department of Fish and Game regulates activities within wetlands under California state law (Fish and Game Code Section 1600-1607). Approximately 157,826 square meters (39 acres) of drainages on the SSFL meet the U.S. Army Corps of Engineers definition of "waters of the United States," of which approximately 60,700 square meters (15 acres) are jurisdictional wetlands. Approximately 360,167 square meters (89 acres) of drainages are streambed and associated riparian habitat identified by the California Department of Fish and Game. Any impacts to jurisdictional waters on the SSFL would require authorization from the U.S. Army Corps of Engineers or the California Department of Fish and Game.

4.4.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would not affect water quality or water resources. None of the activities would result in releases of radioactively contaminated liquid effluents or any impacts to jurisdictional waters on the SSFL.

4.4.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Implementation of Alternative 2 would not affect water quality or water resources. None of the activities would result in releases of radioactively contaminated liquid effluents or any impacts to jurisdictional waters on the SSFL.

4.4.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect water quality or water resources. Continuous monitoring has revealed no groundwater or surface water radiological contamination (with the exception of localized tritium onsite at levels below drinking water standards) that resulted from nuclear operations at ETEC and Area IV. Because institutional controls would be maintained onsite, no radiological releases to groundwater or surface water would be expected.

4.5 HUMAN HEALTH

4.5.1 Current Conditions

Radioactive and chemical contamination in the soil, radioactive air emissions, and radioactive and chemical contamination in water resources (as described in Sections 4.2.1, 4.3.1, and 4.4.1, above) have resulted in public and worker exposure to very low levels of radiation and hazardous chemicals. As documented in the *Site Environmental Report for Calendar Year 2000* issued for DOE operations at ETEC, exposure of the maximally exposed member of the public to radiation from all pathways (internal and external) was estimated to be 7.7 x 10^{-7} millirem per year. Based on current internationally recognized risk factors, this dose results in 3.9 x 10^{-13} latent cancer fatalities annually. For the population within 80 kilometers (50 miles) of the site, ETEC activities in 2000 resulted in a release of 2.2 x 10^{-4} person-rem. This dose results 1.1 x 10^{-7} latent cancer fatalities annually in a population of approximately 10 million.

Radionuclides of Concern

The radionuclides of concern at ETEC are uranium-238, thorium-232, strontium-90, cobalt-60, cesium-137, and tritium. Other radionuclides present in soil samples taken in and around ETEC are either from naturally occurring sources or global fallout. Of the five radionuclides of concern, only cesium-137 has a maximum observed concentration exceeding 10 percent of the release criteria for soil. If the maximum observed concentration of a radionuclide is below 10 percent of the release criteria, it is highly unlikely that this radionuclide would pose any risk to the public or the environment. For this reason, the public and worker exposure estimates are based on exposures to cesium-137, which is considered to be the primary radiological risk driver at ETEC.

For workers, the average measured radiation exposure that an individual worker received at ETEC in 2000 was 7 millirem. This is 0.35 percent of the annual 2,000-millirem administrative control limit for radiation workers at ETEC. It also represents a probability of a latent cancer fatality to a worker of about 3 in 1 million.

Approximately 197,000 liters (52,000 gallons) of nonradioactive metallic sodium are present onsite in the SPTF. Although a hazardous material, the sodium is not a contaminant and is currently in safe storage awaiting reuse.

The major chemical groundwater contaminant at the site, TCE, can be toxic even at low concentrations. Other chemical groundwater contaminants are petrochemicals (diesel fuel, lubricants, oil, and grease), copper, and lead. Mercury, antimony, copper, and cadmium have also been found in surface water at levels slightly above permitted guidelines. The potential health risks of the chemical contamination and all remediation of chemical contamination on the SSFL are being addressed under the RCRA process.

Human Health Effects Methodology

To estimate the *public* doses and potential human health effects resulting from the implementation of Alternatives 1 and 2, DOE averaged site air emissions data from 1996-1998 when DOE decontaminated and demolished the Hot Laboratory and remediated the radioactively contaminated soil surrounding the building. This laboratory was built in 1959 and operated until 1988. It was a 1,500-square-meter (16,000-square-foot) facility and had four large hot cells with remote manipulators and cranes. It was used to handle and examine highly radioactive items such as used reactor fuel assemblies and other test specimens. It was also used to manufacture sealed radioactive sources, do leak checks on sources, and do cutting and machining operations on radioactive cobalt-60.

DOE assumed that public exposure resulting from the decontamination, demolition, and soil remediation for the Hot Laboratory that occurred in 1996-1998 would be similar to the expected exposure for the RMHF, Building 4059, and Building 4024. To be conservative (that is, to overestimate the potential environmental impacts), DOE assumed that all three buildings would be decontaminated and demolished at the same time and that exposure to radiation from each of these facilities would be the same as for the Hot Laboratory. Therefore, DOE multiplied the average dose resulting from the decontamination, demolition, and soil remediation of the Hot Laboratory by three to conservatively estimate the impacts of decontamination, demolition, and soil remediation at the RMHF and Buildings 4059 and 4024.

To estimate *worker* doses and potential health effects, DOE averaged site worker exposure data from 1991 and 1992. These doses were the highest reported over the last 10 years.

To estimate the potential health effects of the No Action Alternative for the public and workers, DOE used the site air emissions data for 2000.

Exposure data were derived from ETEC Annual Site Environmental Reports, National Emission Standards for Hazardous Air Pollutants Annual Reports, and DOE's Radiation Exposure Monitoring System (available at http://rems.eh.doe.gov). For more information on radiation and human health, *see* Appendix C.

4.5.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Radiological Impacts to the Public. Implementation of Alternative 1 would result in an annual 2.8 x 10^{-3} millirem dose to the maximally exposed member of the public through the air pathway (no exposure would be expected through any other pathway). This exposure would result in 1.4 x 10^{-9} latent cancer fatality risk. The total dose to this individual over the 5-year duration of the alternative would be 1.4 x 10^{-2} millirem, which would result in 7.0 x 10^{-9} latent cancer fatality risk.

The maximum additional annual dose to the public within 80 kilometers (50 miles) of the site would be 0.11 person-rem. This would result in 5.6 x 10^{-5} latent cancer fatalities within this population. The total dose to the public for the 5-year duration of the alternative would be 0.56 person-rem, which would result in a maximum of 2.8 x 10^{-4} latent cancer fatalities within the population during that time period.

Following cleanup, a person residing on the site for 40 years would be exposed to a maximum additional total of 600 millirem, which would result in 3 x 10^{-4} latent cancer fatalities over that period. A site population of 500 people would receive a total of 300 person-rem over 40 years, resulting in 0.15 latent cancer fatalities within the population residing on the site for that period of time. For comparison purposes, this population would be expected to incur approximately 3 latent cancer fatalities as a result of exposure to background radiation during this time period.

Radiological Impacts to Workers. Implementation of Alternative 1 would result in an annual 470-millirem dose to the average worker. This exposure would result in 1.9 x 10^{-4} latent cancer fatality risk. The total dose to this individual over the 5-year duration of the alternative would be 2,345 millirem, which would result in 9.4 x 10^{-4} latent cancer fatality risk.

The annual dose to the worker population at ETEC would be 10.3 person-rem. This would result in 4.1 x 10^{-3} latent cancer fatalities within this population. The total dose to the worker population for the duration of the alternative would be 52 person-rem, which would result in 2.1 x 10^{-2} latent cancer fatalities within the ETEC worker population.

Sodium Removal. Based on past experience with removal of sodium from the Sodium Component Test Installation and other former sodium facilities, removal of the nonradioactive sodium from the SPTF would not result in any human health impacts under routine operations. The impacts of a potential accident during the removal process are addressed below.

Facility Accidents. Implementation of Alternative 1 could result in industrial accidents at the three radiological facilities, the one sodium facility (SPTF), or the other uncontaminated support buildings. These accidents could consist of (1) accidents that are typical of industrial settings, or (2) accidents that involve the radioactive or sodium materials in the buildings being decontaminated and demolished.

Under Alternative 1, no worker fatalities (5.2 x 10^{-3} fatalities) would be expected as a result of industrial accidents.

DOE also analyzed a potential accident in the RMHF to estimate radiological impacts to members of the public and workers. In the bounding accident (the accident that would have the highest consequences), which would be a fire involving radioactive materials, the maximally exposed individual member of the public would receive a 7-millirem dose, resulting in a 3.5 x 10^{-6} probability of incurring a latent cancer fatality. The radiation dose to the population within 80 kilometers (50 miles) of the site would be 990 person-rem, resulting in 0.5 latent cancer fatalities within a population of 10 million people. A worker located 100 meters (330 feet) from the accident would receive a 1,700-millirem dose (1.7 rem). This would result in a 7.0 x 10^{-4} probability of incurring a latent cancer fatality. An accident involving radiological materials at Buildings 4059 and 4024 would have fewer impacts because the radiological inventory at those buildings is far less than that in the RMHF. The probability that such an accident could occur at any of the radiological facilities is low, given the existence of alarms, smoke detectors, sprinkler systems, and fire extinguishers within the facilities.

Sodium is highly reactive. Thus, an accident involving the removal of sodium from the SPTF into portable transfer vessels could result in serious injuries or death to workers located near the site of the accident.

4.5.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Radiological Impacts to the Public. Implementation of Alternative 2 would result in the same annual dose to the maximally exposed member of the public as under Alternative 1. However, because implementation of Alternative 2 would take 8 years, rather than 5 under Alternative 1, the total dose would be larger.[8] The total dose to this individual over the 8-year duration of the alternative would be 2.2 x 10^{-2} millirem, which would result in 1.1 x 10^{-8} probability of a latent cancer fatality.

The annual dose to the public within 80 kilometers (50 miles) of the site would be the same as under Alternative 1. The total dose to the public for the 8-year duration of the alternative would be 0.9 person-rem, which would result in 4.5 x 10^{-4} latent cancer fatalities within the population during that time period.

Following cleanup, a person residing on the site for 40 years would be exposed to a total of 2.0 millirem, which would result in 1 x 10^{-6} latent cancer fatalities. A site population of 500 people would receive a total of 1.0 person-rem over 40 years, resulting in 5 x 10^{-4} latent cancer fatalities within the population residing on the site for that period of time. For comparison purposes, this population would be expected to incur approximately 3 latent cancer fatalities as a result of exposure to background radiation.

Radiological Impacts to Workers. Implementation of Alternative 2 would result in the same annual dose to the average worker as under Alternative 1. However, the total dose would be larger because of the longer duration of Alternative 2 as compared to Alternative 1. The total dose to this individual over the 8-year duration of the alternative would be 3,760 millirem, which would result in 1.5 x 10^{-3} probability of a latent cancer fatality.

The annual dose to the worker population at ETEC would be the same as under Alternative 1. The total dose to the worker population for the 8-year duration of the alternative would be 82 person-rem, which would result in 3.3 x 10^{-2} latent cancer fatalities within the ETEC worker population.

Sodium Removal. Based on past experience with removal of sodium from the Sodium Component Test Facility and other former sodium facilities, removal of the liquid sodium from the SPTF would not result in any human health impacts under routine operations.

Facility Accidents. Implementation of Alternative 2 could result in the same type of accidents as could occur under Alternative 1. The consequences of a radiological or sodium accident would be the same as described under Alternative 1. Because more soil remediation would occur under Alternative 2 than under Alternative 1, the potential for industrial accidents at the site would increase, although no fatalities (6.5 x 10^{-3} fatalities) would be expected as a result of industrial accidents.

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8 Once decontamination and demolition of the radiological facilities was completed, doses to the public and to workers would be reduced. However, to determine the doses to the public and workers from soil remediation alone would require complex modeling. Because the doses are already small, and for ease of analysis, DOE simply assumed – conservatively – that the doses to the public and to workers from decontamination, demolition, and soil remediation would continue for the entire 8-year duration of Alternative 2.

4.5.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Radiological Impacts to the Public. Based on exposures experienced in 2000, implementation of the No Action Alternative would result in an annual 7.7×10^{-7} millirem dose to the maximally exposed member of the public. This exposure would result in 3.9×10^{-13} probability of a latent cancer fatality. The annual dose to the public within 80 kilometers (50 miles) of the site would be 2.2×10^{-4} person-rem. This would result in 1.1×10^{-7} latent cancer fatalities within this population. These annual impacts would occur indefinitely.

Radiological Impacts to Workers. Implementation of the No Action Alternative would result in an annual 7-millirem dose to the average worker. This exposure would result in 2.8×10^{-6} probability of a latent cancer fatality. The annual dose to the worker population at ETEC would be 0.92 person-rem. This would result in 3.7×10^{-4} latent cancer fatalities within the worker population. These annual impacts would occur indefinitely.

Sodium Removal. Implementation of the No Action Alternative would cause the sodium to remain onsite. This material would be maintained in its solid state. Abandonment of the facility and the sodium would cause the sodium to be classified as hazardous waste and the removal of the sodium would be required.

Facility Accidents. Implementation of the No Action Alternative would not be expected to result in any fatalities due to accidents because no decontamination, demolition, or soil remediation activities would be conducted and institutional controls would be maintained.

4.6 BIOLOGICAL RESOURCES

4.6.1 Current Conditions

The undeveloped areas within the SSFL site, both in open space and in the natural areas surrounding the developed site areas, consist of a large area of diverse habitats. This diversity is reflected in a wide variety of plants and animals at the site. The habitat and species diversity associated with the SSFL property, the physical attributes of the facility, and its geographic location make the area a potentially important route for effective movement of species. The open space at the site may play an important role as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and possibly the Santa Monica Mountains.

Appendix D identifies the sensitive species observed or potentially occurring at the SSFL site (plants; reptiles; aquatic, amphibian, and insect species; birds; and mammals). Species are designated as sensitive because of their overall rarity, status, unique habitat requirements, and/or restricted distribution. Sensitive species include those listed by the U.S. Fish and Wildlife Service under the Endangered Species Act, 16 U.S.C. 1531 *et seq.*, or the California Department of Fish and Game under state preservation laws as threatened or endangered, protected, rare, candidate species, special animals, species of special concern, or harvest species.

Of those that could occur at the SSFL, several have been observed in surveys of the area. These are as follows:

- Santa Susana tarplant (state sensitive species)
- Southern California black walnut (candidate state sensitive species)
- Braunton's milkvetch (federal endangered and candidate state sensitive species)
- Two-striped garter snake (state special animal)
- Double-crested cormorant (state species of special concern)
- Great blue heron (state special animal)

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- Southern California rufous-crowned sparrow (state species of special concern)
- Loggerhead shrike (state species of special concern)
- Sharp-skinned hawk (state species of special concern)
- Cooper's hawk (state species of special concern)
- Bobcat (state harvest species)
- Mule deer (state harvest species)
- San Diego black-tailed jackrabbit (state species of special concern)
- Los Angeles little pocket mouse (under review for federal threatened or endangered status; state species of special concern)
- Ringtail (state protected species).

In addition, Coast Live Oak trees, which are protected by Ventura County, California, are found on the site. Any work on a tree or in the ground within a protection zone surrounding the protected tree is subject to ordinance requirements. The County of Ventura is contacted before the trimming of branches or roots or grading or excavating within the root zone of a protected tree and a permit is issued as required. The services of a qualified tree trimmer may be required to oversee the activities taking place near a protected tree.

Most common species as well as sensitive species of plants and animals are not affected by exposure to low levels of radiological contamination. The territorial range of large animals limits their exposure duration at a contaminated site. The short life span of smaller animals limits the cumulative radiation dose that would be required to induce cancer.

In any event, because radiation doses to humans have been found to be very low (*see* Table 4-1), doses to plants and animals are also assumed to be very low. The impacts from those doses are unlikely to affect the population of any species.

Vegetation has been sampled throughout ETEC's operational period and DOE has continued this sampling during site cleanup activities. No evidence of any radioactive contamination in vegetation has ever been found.

No other natural resources such as timber, minerals, or rangeland are present on the site.

Brush Fires

In 2000, a concern was raised about brush fires in and around contaminated sites at the SSFL. The concern centered on the potential for brush and vegetation growing on contaminated land to become contaminated. Subsequent fires could then result in airborne contamination, which could be a hazard to firefighters and the surrounding community.

To address this concern, comprehensive vegetation sampling was conducted in Area IV in 2000. One composite vegetation sample (a variety of vegetation at each location) was collected at each of 28 existing and legacy radiological facilities. For comparison purposes, two offsite samples were collected to determine the natural background. The only radionuclide found in the vegetation samples was naturally occurring potassium-40. No man-made radionuclides were found in either the onsite or offsite vegetation samples. This latest finding confirms the results from earlier sampling conducted at the SSFL.

4.6.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

While implementation of Alternative 1 could have some short-term adverse effects on local plant and wildlife populations, these effects would be minimal because the actions would be limited to areas that are already highly disturbed and industrial in nature. No threatened, endangered, or sensitive species would be affected because they are not present in the areas where the work would be performed. In the long term, the remediation of Area IV would increase habitat availability, and the site may become more effective as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and the Santa Monica Mountains. No other natural resources would be affected.

4.6.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Implementation of Alternative 2 would also have some short-term adverse effects on local plant and wildlife populations. These effects would be more widespread because of the additional soil remediation that would occur in Area IV. The additional land disturbance could increase the potential for the disturbance of threatened, endangered, or sensitive plant and animal species, disturbance of migratory bird species that might roost in the area, and the introduction of non-native plant and weed species. Potential adverse impacts to threatened or endangered species would require consultation with the U.S. Fish and Wildlife Service and the preparation of a biological assessment.

In the long term, however, the remediation of Area IV would increase habitat availability, and the site may become more effective as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and the Santa Monica Mountains. No other natural resources would be affected.

4.6.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would avoid the short-term adverse effects on local plant and wildlife populations. Because the site would be maintained in its current state, the condition of the habitats for plants and animals would not be improved.

4.7 CULTURAL RESOURCES

4.7.1 Current Conditions

An intensive archeological survey was conducted for Area IV in 2001. This involved (1) background studies reviewing the prehistory, ethnography, and historical land use of the study area; (2) an archival records search to determine whether any prehistoric or historical archaeological sites had been recorded or were known to exist; and (3) an on-foot survey of the study area.

This survey of the entire Area IV study area resulted in the identification and recording of four archaeological sites. Each of these is located in rocky, undeveloped areas and is associated with a rock shelter or a cave. These sites are:

- A rock painting on the back wall of a small sandstone cave, probably Euro-American in origin
- A rock shelter exhibiting fire-blackened walls and ceiling that appears to represent a small special-use area
- A single bedrock mortar located on an open boulder adjacent to a rock shelter

- A low rock shelter that contains a midden deposit and bedrock mortar (the site currently lacks integrity because of previous artifact looting that has occurred)

None of these sites are eligible for inclusion on the National Register of Historic Places. Further, the sites are all located in rocky areas that have not been developed or used during DOE operations at ETEC.

4.7.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Because no remediation would occur at or near any of the four identified archaeological sites, implementation of Alternative 1 would not affect cultural resources at Area IV. Limited remediation of soil near the RMHF would not be expected to result in the discovery of as-yet-unknown archaeological or cultural resources.

4.7.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Because no remediation would occur at or near any of the four identified archaeological sites, implementation of Alternative 2 would not affect known cultural resources at Area IV. However, the additional land disturbance required under Alternative 2 could increase the potential for the disturbance of as-yet-undiscovered archaeological or cultural resources. Discovery of such resources during remediation would require a cessation of activities and consultation with the State Historic Preservation Officer.

4.7.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would not affect any of the four identified archaeological sites.

4.8 NOISE AND AESTHETICS

4.8.1 Current Conditions

The SSFL and Area IV are industrial areas and have sound and aesthetic characteristics typical of such areas. However, because most operational activities at Area IV have ceased, the site is frequently quiet. Because of the remote location in a relatively remote, mountainous area, no sound from normal DOE operations travels offsite. Some ETEC facilities can be seen from offsite locations.

4.8.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would result in the generation of noise at levels above the current operational level. However, this would be temporary and no noise would travel off the site because of its remote location. At the conclusion of decontamination, demolition, regrading, and revegetation, the site would be restored to its natural condition.

Transportation of waste offsite would generate noise and vibrations along truck routes, particularly in the residential neighborhoods closest to the site. Approximately 2 trucks per day (offsite waste shipments) would travel over local roads for the 5 years required to implement Alternative 1.

4.8.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Implementation of Alternative 2 would result in the generation of noise at levels above the current operational level, and for a slightly longer period of time (3 years longer) than Alternative 1. However, this would be temporary and no noise would travel off the site because of its remote location. At the conclusion of decontamination, demolition, regrading, and revegetation, the site would be restored to its natural condition.

Transportation of waste offsite would generate noise and vibrations along truck routes, particularly in the residential neighborhoods closest to the site. Approximately 27 trucks per day (offsite waste shipments and transport of clean soil to the site) would travel over local roads for the 8 years required to implement Alternative 2.

4.8.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in no change to the current noise levels and aesthetic conditions of the site. Truck traffic in the residential neighborhoods nearest the site would not increase.

4.9 SOCIOECONOMICS

4.9.1 Current Conditions

Based on a recent demographic survey (based on census data and modified by direct observations of nearby residential areas around the SSFL site), DOE estimates that 1,403 people live within 3.2 kilometers (2 miles) of the center of the SSFL. Currently, residents live directly adjacent to the eastern and southern site boundaries, and two mobile home parks are located east of the site on Woolsey Canyon Road. According to maps and direct observation, there are no schools, nursing homes, or other facilities within 1.6 kilometers (1 mile) of the site boundary. Approximately 69,398 people live within 8 kilometers (5 miles) of the site.

The SSFL currently employs 280 people, 22 of whom are employed at ETEC.

4.9.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would require approximately 40 additional workers onsite for the 5-year duration of the alternative. This slight increase in personnel would not affect socioeconomic conditions in the region.

4.9.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1×10^{-6} Risk Standard)

Implementation of Alternative 2 would require approximately 55 additional workers onsite for the 8-year duration of the alternative. This slight increase in personnel would not affect socioeconomic conditions in the region.

4.9.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would require no additional workers for 1 year and fewer workers (approximately 15 workers) in each subsequent year to monitor and secure the remaining ETEC buildings. This level of effort would not affect socioeconomic conditions in the region.

4.10 WASTE MANAGEMENT

4.10.1 Current Conditions

As discussed in Section 2.4, ETEC manages LLW, MLLW, and TRU waste at ETEC. LLW continues to be generated each year as a result of ongoing site closure activities. MLLW is not routinely generated, and TRU waste is no longer generated at the ETEC site.

DOE sends LLW generated at ETEC to the Nevada Test Site near Las Vegas, Nevada, the Hanford Site in Richland, Washington, or Envirocare, a commercial radioactive waste disposal facility in Clive, Utah, for disposal. DOE sends the majority of MLLW generated at ETEC to Envirocare. DOE will send its TRU waste from ETEC to WIPP for disposal.

Small amounts of hazardous waste are generated and disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA. Nonhazardous debris waste is also generated at ETEC. This type of debris includes asphalt, concrete, and building materials. Debris waste is disposed of at a local municipal sanitary landfill.

Table 4-2 lists the waste volumes that are currently stored onsite and the volumes that were generated at ETEC in fiscal year 2001.

Table 4-2. Waste Volumes Stored and Generated

Waste Type	Volume Currently Stored Onsite (cubic meters)[a]	Volume Generated in Fiscal Year 2001 (cubic meters)
LLW	75	50
MLLW	20	5
TRU Waste	11	0
Hazardous Waste	0	1
Nonhazardous Debris Waste	0	50

a. To convert cubic meters to cubic feet, multiply by 35.3.

4.10.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would result in the generation of the following quantities of waste:

- 7,500 cubic meters (264,750 cubic feet) of LLW
- 20 cubic meters (706 cubic feet) of MLLW
- 5 cubic meters (180 cubic feet) of hazardous waste
- 25,300 cubic meters (893,500 cubic feet) of nonhazardous debris waste

As discussed in Section 3.2, the volume of soil that would need to be remediated in the implementation of Alternative 1 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 1.2 square kilometers (290 acres) of Area IV. Soil sample data taken from the RMHF in 2000 was also used. All excavated soil would be managed as LLW.

Disposal of Debris and Recycling

DOE has imposed a moratorium on the unrestricted release for recycling of any metals from radiation areas within a DOE facility, pending the completion of an environmental impact statement on the disposition of radioactively contaminated scrap metals (Memorandum for Heads or Department Elements from Bill Richardson, Secretary of Energy, dated January 19, 2001).

For former radiological facilities, DOE disposes of uncontaminated building debris (including formerly contaminated material that has been decontaminated) in municipal sanitary landfills. Before such materials can be disposed of, the legal process of "releasing a building for unrestricted use" must be completed. Completion of this process means:

- Cleanup standards have been met and verified;
- The regulatory agency imposes no further radiological controls or regulatory oversight for the building;
- The regulatory agency removes the building from the existing "Radioactive Material License;"
- The building can be used safely for any other purposes without any further radiological controls;
- The building can be demolished safely and disposed of at regular landfills without any further radiological controls; and
- Any other material from the building, including metal, can be safely reused or recycled without any further radiological controls.

4.10.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1 x 10^{-6} Risk Standard)

Implementation of Alternative 2 would result in the generation of following quantities of waste:

- 406,850 cubic meters (14.4 million cubic feet) of LLW
- 20 cubic meters (706 cubic feet) of MLLW
- 5 cubic meters (180 cubic feet) of hazardous waste
- 25,300 cubic meters (893,500 cubic feet) of nonhazardous debris waste

As discussed in Section 3.3, the volume of soil that would need to be remediated in the implementation of Alternative 1 was derived using a 1995 Area IV radiological survey, the most recent characterization of all 1.2 square kilometers (290 acres) of Area IV. Soil sample data taken from the RMHF in 2000 was also used. All excavated soil would be managed as LLW.

4.10.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in the generation of minimal amounts of LLW and nonhazardous debris waste as a result of continuing monitoring and maintenance of institutional controls.

4.11 TRANSPORTATION

4.11.1 Current Conditions

As noted above, DOE ships LLW generated at ETEC to the Nevada Test Site near Las Vegas, Nevada, the Hanford Site in Richland, Washington, or Envirocare, a commercial radioactive waste disposal facility in Clive, Utah, for disposal. DOE ships most MLLW generated at ETEC to Envirocare. Some MLLW is treated on site and then disposed of appropriately. DOE will ship its TRU waste from ETEC to WIPP for disposal. Small amounts of hazardous waste are disposed of in commercial, licensed hazardous waste disposal facilities in accordance with RCRA. Nonhazardous debris waste is disposed of at local, licensed refuse disposal sites. All transportation is by truck.

Table 4-3 lists the truck shipments by waste type that occurred at ETEC in fiscal year 2001.

Table 4-3. Offsite Waste Shipments

Waste Type	Number of Truck Shipments in Fiscal Year 2001
LLW	5
MLLW	1
TRU Waste	0
Hazardous Waste	0
Nonhazardous Debris Waste	20

The potential environmental impacts of transporting LLW, MLLW, TRU waste, and hazardous waste by truck from ETEC to authorized disposal sites has been addressed in earlier NEPA documents (*see* Section 2.4). The remainder of this section identifies the number of truck shipments of LLW, MLLW, TRU waste, and hazardous waste that would occur under each alternative and focuses on the potential environmental impacts of transporting nonhazardous debris waste and sodium offsite. Traffic fatalities that could occur as a result of LLW shipments and as a result of pollution from vehicle exhaust from all shipments are also reported.

4.11.2 Impacts of Alternative 1 (Cleanup and Closure Under DOE Standard)

Implementation of Alternative 1 would result in the following numbers of truck shipments:

- 553 truck shipments of LLW
- 20 truck shipments of MLLW
- 5 truck shipments of TRU waste
- 5 truck shipments of hazardous waste
- 1,860 truck shipments of nonhazardous debris waste
- 11 truck shipments of sodium (for reuse)

For LLW, hazardous waste, and nonhazardous debris waste, DOE assumed that each truckload would carry 13.6 cubic meters of waste.

LLW. The 553 truck shipments of LLW required under Alternative 1 would not be expected to result in any traffic fatalities (2.5×10^{-2} fatalities) (for purposes of analysis, DOE assumed that all LLW would be shipped to Nevada Test Site, which is the closest and currently the less expensive disposal alternative).[9] Other impacts of transporting LLW, including the impacts of an accident in which LLW is released, are addressed in the *Environmental Assessment of Off-Site Transportation of Low-Level Waste from Four California Sites* issued by DOE in 1997. This EA concluded that the environmental impacts (human health, traffic, air quality, noise, and environmental justice) of the transportation of LLW would be minimal.

Nonhazardous debris. The 1,860 shipments of debris waste would result in no fatalities (5.7×10^{-3}) as a result of traffic accidents.

Sodium. The 197,000 liters (52, 000 gallons) of liquid sodium in the SPTF would be transferred to portable transfer vessels provided by a new owner of the sodium. DOE would build a system capable of transferring the sodium from the SPTF to the new owner's vessels. The sodium would be allowed to cool by means of heat loss through the vessel's insulation to the surrounding atmosphere and would become solid. Then the new owner would transport the solid sodium offsite.

Transportation of hazardous materials such as sodium must meet Department of Transportation shipping regulations. These regulations include requirements and specifications for shipping papers, packaging, marking, labeling, placarding, emergency response training, and route selection (*see* 49 CFR Parts 171, 172, and 178). The sodium would be transported as a solid. However, in the event of an accident involving a release of sodium, the rupture of a tank or fire may result if there were significant moisture in the air or water present.

Exhaust emissions. The 2,443 truck shipments required for all shipments under Alternative 1 would result in exhaust emissions from the trucks. These emissions would not be expected to result in any fatalities (6.0×10^{-3} fatalities).

4.11.3 Impacts of Alternative 2 (Cleanup and Closure Using a 1×10^{-6} Risk Standard)

Implementation of Alternative 2 would result in the following numbers of truck shipments:

- 30,000 truck shipments of LLW
- 20 truck shipments of MLLW
- 5 truck shipments of TRU waste
- 5 truck shipments of hazardous waste
- 1,860 truck shipments of nonhazardous debris waste
- 11 truck shipments of sodium (for reuse)

For LLW, hazardous waste, and nonhazardous debris waste, DOE assumed that each truckload would carry 13.6 cubic meters of waste. In addition, approximately 26,000 shipments of clean soil would have to be brought to the site as backfill for revegetation.

LLW. DOE assumed that all of the soil excavated under Alternative 2 would be disposed of as LLW, although much of it could be considered to be clean soil. The 30,000 truck shipments of LLW required under Alternative 2 could result in 1.4 traffic fatalities (for purposes of analysis, DOE assumed that all LLW would be shipped to Nevada Test Site, which is the closest and currently the less expensive disposal alternative). Other impacts of transporting LLW, including the impacts of an accident in which LLW is released, are addressed in the *Environmental Assessment of Off-Site Transportation of Low-Level Waste*

[9] Traffic fatalities were calculated by applying the traffic-fatality-per-kilometer-traveled rate provided in NUREG-1496.

from Four California Sites issued by DOE in 1997. This EA concluded that the environmental impacts (human health, traffic, air quality, noise, and environmental justice) of the transportation of LLW would be minimal.

Nonhazardous debris waste. The consequences of an accident involving shipments of nonhazardous debris waste would be the same as those described for Alternative 1.

Sodium. The consequences of an accident involving a shipment of sodium would be the same as those described for Alternative 1.

Exhaust emissions. The 31,807 truck shipments required for all shipments under Alternative 2 would result in exhaust emissions from the trucks. These emissions would not be expected to result in any fatalities (0.23 fatalities).

4.11.4 Impacts of No Action Alternative (No Further Cleanup and Secure the Site)

Implementation of the No Action Alternative would result in fewer than five truck shipments of LLW and nonhazardous debris waste to offsite disposal sites annually. No impacts would be expected.

4.12 ENVIRONMENTAL JUSTICE

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

In February 1994, the President issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 Fed. Reg. 7629 (1994)). This Order directs federal agencies to incorporate environmental justice as part of their missions. As such, federal agencies are specifically directed to identify and address as appropriate disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations.

The Council on Environmental Quality has issued guidance to federal agencies to assist them with their NEPA procedures so that environmental justice concerns are effectively identified and addressed (*Guidance for Considering Environmental Justice Under the National Environmental Policy Act* [December 10, 1997]). In this guidance, the Council encouraged federal agencies to supplement the guidance with their own specific procedures tailored to particular programs or activities of an agency. DOE has prepared a document entitled "Draft Guidance on Incorporating Environmental Justice Considerations into the Department of Energy's National Environmental Policy Act Process" (April 2000). DOE's draft guidance is based on Executive Order 12898 and the Council on Environmental Quality environmental justice guidance.

Among other things, the DOE draft guidance states that even for actions that are at the low end of the sliding scale with respect to the significance of environmental impacts, some consideration (which could be qualitative) is needed to show that DOE considered environmental justice concerns. DOE needs to demonstrate that it considered apparent pathways or uses of resources that are unique to a minority or low-income community before determining that, even in light of these special pathways or practices, there are no disproportionately high and adverse impacts on the minority or low-income population. The DOE draft

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guidance also defines "minority population" as a demographic composition of the populace where either the minority population of the affected area exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population.

For this EA, DOE applied the draft environmental justice guidance to determine whether there could be any disproportionately high and adverse human health or environmental impacts on minority or low-income populations surrounding ETEC as a result of the implementation of any of the alternatives analyzed. Analysis of environmental justice concerns was based on an assessment of the impacts reported in Sections 4.1 through 4.11. Although no high and adverse impacts were identified, DOE considered whether minority or low-income populations would be disproportionately affected by the alternatives.

There are no minority or low-income populations immediately adjacent to ETEC or the SSFL. The primary impact to the area around the SSFL would be a temporary increase in car and truck traffic.[10] This increase in traffic would be noticeable only in the immediate area, where no minority or low-income populations have been identified. Because no other offsite impacts are anticipated, DOE believes that no minority or low-income populations would be disproportionately affected by the alternatives.

4.13 MITIGATION

The results of the environmental analysis conducted for this EA indicate that implementation of Alternative 1 or 2 would not result in significant environmental impacts. However, DOE would use standard practices to further reduce the environmental impacts of these alternatives. These practices would include:

- Dust suppression, sediment controls, personnel protective equipment, monitoring, and compliance with safety and health plans to reduce radiation exposure to workers and the public through the air pathway

- Protection of undiscovered cultural resources by compliance with established operating procedures regarding preservation of archaeological sites (if such resources are discovered, excavation or other activities would stop until all required steps were taken to preserve the resource)

- Protection of sensitive plant species by adherence to established operating procedures, including hiring a qualified tree trimmer to oversee the activities taking place near a protected tree

- Limitations on transportation hours, trucks per hour, and trucks per day to reduce impacts to roads and neighborhoods; implementation of traffic control and loading procedures that address local traffic hazards, noise restrictions, city/county approval, manifesting, dust suppression, truck decontamination, environmental monitoring, container cover, truck inspection, and spill/release control

- Compliance with Department of Transportation shipping requirements (including proper packaging; limitations on waste quantities per shipment; and preparation of and compliance with spill prevention, control, and cleanup plans) to protect transportation workers and the public from exposure to contaminants in the waste

[10] The increase in traffic would occur over a period of 5 to 8 years, depending on the alternative selected. Car traffic would increase due to onsite workers commuting to ETEC. Truck traffic would increase due to offsite shipment of waste and shipment of clean soil to the site if needed for Alternative 2.

- Maintenance of sediment control structures and related access restrictions to prevent additional migration of mercury

- Continuation of institutional controls and pump-and-treat systems to protect the public from potential exposure to TCE through the groundwater pathway

4.14 CUMULATIVE IMPACTS

Council on Environmental Quality regulations implementing the procedural provisions of NEPA require federal agencies to consider the cumulative impacts of a proposal (40 CFR 1508.25(c)). A cumulative impact on the environment is the impact that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). This type of assessment is important because significant cumulative impacts can result from several smaller actions that by themselves do not have significant impacts.

ETEC is located in a remote area with no other major industrial or commercial centers surrounding it. Thus, there is no potential for cumulative impacts from other present or reasonably foreseeable future actions, other than from activities at the site.

DOE and its predecessor agencies conducted nuclear research and energy development projects at ETEC from the late 1950s until the mid-1990s. Activities at ETEC included nuclear operations (development, fabrication, and disassembly of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium metal experiments for testing of liquid metal fast breeder reactor components. As a result of these and other activities, the site contains radioactive and chemical contamination. Hazardous materials such as asbestos insulation and lead-based paint may also be present in some buildings.

In addition, the SSFL has been used for various research, development, and test projects funded by the Department of Defense and NASA. These activities included rocket and laser testing and have resulted in chemical contamination of the site. Cleanup of the chemical contamination will be conducted pursuant to RCRA corrective action program. DOE assumes that the cleanup of chemical contamination on the SSFL will result in a residual cancer risk of between 1×10^{-4} and 1×10^{-6}. After remediation and application of the ALARA principle (see Section 3.2.1.1), the cleanup of radiological contamination at the site would result in a residual cancer risk of between 1×10^{-4} and 1×10^{-6}.

Cleanup of ETEC radiological facilities in Area IV under Alternative 1 or 2 and hazardous chemical cleanup of the SSFL under RCRA could have cumulative impacts, although those impacts would not be expected to be significant. Such impacts could include cumulative health risks to the public and workers and cumulative transportation impacts. Such cumulative impacts would occur only for the duration of the cleanup activities. At the conclusion of the radiological and hazardous chemical cleanup activities, the public and workers would experience a reduced potential for human health effects.

The shipment of radioactive, hazardous, and nonhazardous wastes from ETEC to offsite disposal sites and the shipment of sodium for reuse offsite would affect people located along the highway between the site and the offsite facilities. As described in earlier NEPA documentation and in Section 4.11, these impacts include (1) the direct effect of radiation exposure to people using, working along, and residing along the selected corridors, and (2) traffic accidents. Transportation workers and the general public using, working along, and residing along the selected transportation corridors could also be affected by shipments of radioactive waste or materials from other sites. This situation would be particularly true for individuals residing along the major interstate highways used as access routes to the waste disposal sites.

The relatively few truck shipments over 5 years under Alternative 1 (2,443 truck shipments or an additional 2 trucks per day for 5 years) in comparison to other radioactive waste and materials shipments and truck shipments generally would not pose cumulatively significant environmental impacts in the local area or in the southern California region. Implementation of Alternative 2, which would require 56,000 truck shipments over 8 years (or approximately 27 additional trucks per day over that period of time) for offsite transportation of waste and transport of clean soil to the site, would not impose cumulatively significant environmental impacts when considered in combination with other truck shipments in the region, although this amount of truck traffic on the roads near ETEC could impose a hardship on local residents.

5.0 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS, RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY, AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

5.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Under Alternative 1 or 2, there would be a very slight temporary increase in radiation doses to the public and workers as a result of decontamination, demolition, and soil remediation activities, which could result in a very slight increase in excess cancer risk (*see* Section 4.5). The highest increased total dose for the maximally exposed member of the public would be 2.2 x 10^{-2} millirem, which would result in 1.1 x 10^{-8} latent cancer fatalities under Alternative 2. Offsite transportation of waste under Alternatives 1 and 2 and transportation of clean soil to the site under Alternative 2 could also result in slight public and worker radiation exposure and the potential for traffic accident fatalities (*see* Section 4.11).

5.2 RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Implementation of Alternative 1 or 2 would not create a conflict between the local, short-term uses of the environment and long-term productivity. All activities would occur on an already disturbed site or would use existing infrastructure resources such as roads. Environmental resources such as land, plants and animals, wetlands, air quality, and water quality would not be affected by implementation of either of the two action alternatives.

5.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The only irreversible or irretrievable commitment of resources that would occur if Alternative 1 or 2 were implemented is the use of fossil fuels in the shipment of waste off the site and the use of land for the disposal of radioactive wastes. Truck shipments would require the consumption of diesel fuel and other fossil fuels such as gasoline and lubricants. Approximately 50 times more shipments of LLW (including contaminated soil) would be required under Alternative 2 as compared to Alternative 1.

Implementation of Alternative 1 or 2 would also involve the commitment of land for waste disposal facilities. The land-use requirements for the offsite disposal of LLW, MLLW, TRU waste and hazardous waste were addressed in the F*inal Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* and the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*. Disposal of nonhazardous debris waste would be in accordance with local regulations. Approximately 50 times more LLW would be generated and would need to be disposed of under Alternative 2 than Alternative 1 406,850 cubic meters of LLW under Alternative 2 as compared to 7,500 cubic meters of LLW under Alternative 1).

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APPENDIX A. SCOPING COMMENTS SUMMARY AND DOE RESPONSES

Following is a summary of the comments recorded in the October 17 and 18, 2000, *U.S. Department of Energy, Environmental Assessment, Energy Technology Engineering Center, Public Scoping Meetings, Transcript of Proceedings* and written comments received from the U.S. Environmental Protection Agency (EPA). Brief responses by the U.S. Department of Energy (DOE) to these comments are provided. No other comments were received during the comment period that extended from September 15–October 30, 2000.

1. **Comment on Groundwater Plumes:** The groundwater trichloroethene (TCE) plume that is being evaluated does not include the larger plumes for the entire Santa Susana Field Laboratory (SSFL) site. Are these plumes a part of the site groundwater cleanup activities? Are the three plumes connected to the larger plume at SSFL?

   Response:. Cleanup of chemical contamination is being addressed in accordance with the SSFL site-wide Resource Conservation and Recovery Act (RCRA) corrective action program. With respect to the RCRA process, DOE is only responsible for the groundwater plumes that were created as a result of DOE-funded activities. All of the ETEC groundwater plumes are being remediated at this time. The National Aeronautics and Space Administration (NASA), the Department of Defense, and Boeing are responsible for the larger plumes at SSFL. These are separate from the ETEC plumes and are being cleaned up using separate wells and treatment systems in accordance with RCRA permit requirements.

2. **Comment on Cleanup Standards:** It is not clear what standard DOE will use in cleanup of the site. It was recommended that DOE use the EPA standards for residential use as the appropriate cleanup standards. DOE should use rural residential standards rather than residential standards.

   Response: DOE's preferred alternative is to use the cleanup standard approved by DOE, which are consistent with EPA's CERCLA standards, and the California Department of Health Services, Radiologic Health Branch. Under this alternative, DOE would clean up the site such that a resident on the site would be exposed to no more than an additional 15 millirem annually and would experience an additional lifetime cancer risk that would not exceed 3×10^{-4}. This alternative is equivalent to the rural residential scenario. With implementation of the ALARA principle, DOE will be within the CERCLA range. DOE also analyzed an alternative under which the site would be cleaned up to a level such that a resident on the site would be exposed to no more than an additional lifetime cancer risk of 1×10^{-6}. This EA also considers the No Action Alternative of no further cleanup and securing the site.

3. **Comment on National Environmental Policy Act (NEPA) Compliance:** DOE should do an environmental impact statement (EIS) rather than an EA because there is more opportunity for public involvement. Past cleanup activities at the ETEC site have been conducted without proper NEPA documentation.

   Response: DOE believes that an EA is the appropriate level of NEPA documentation for cleanup and closure of ETEC. The purpose of an EA is to determine whether the impacts of a proposal may be significant. Based on past experience, DOE concluded that there was no indication that the impacts of the proposed action or alternative would have significant environmental impacts. With respect to public involvement, DOE issued a notice of intent to prepare the EA, conducted 2 days of scoping meetings, and encouraged the submission of scoping comments. The EA is being put out for public review for a period of 30 days. Thus, the public involvement activities for this EA are similar to that used for the preparation of EISs.

Following the completion of the EA, DOE will evaluate and determine if there are significant impacts. If there are significant impacts, then DOE will prepare an EIS. If no significant impacts are identified following evaluation and considering mitigation, then DOE will conclude the process with a finding of no significant impact.

4. **Comment on Characterization:** Characterization activities have not been completed for the ETEC site. DOE is basing their evaluation on information from Rocketdyne studies that have not been updated in several years. NEPA evaluation should be delayed until characterization is complete.

   The EPA should complete an independent evaluation. The evaluation should include a detailed sampling plan that covers a wide range of sample sites, sample depths, and analyses for radioactive and hazardous materials. Previously released facility sites should be characterized to assure that they comply with current standards.

   Response: Extensive radiological characterization has been conducted at the ETEC site. Additional post-remediation characterization would be performed under the proposed action to verify that cleanup goals have been met. Additional sampling and analysis would also be performed at any sites suspected to be contaminated. Characterization of chemical contamination has also been performed at ETEC. Additional chemical characterization for the entire SSFL, including the ETEC site, is under way pursuant to the RCRA corrective action process. To date, EPA has validated release surveys for eight former radiological facilities. DOE also plans to support an independent verification survey for the site.

5. **Comment on Waste Management:** Waste material and temporary facilities from restoration activities have been shipped to waste sites and donated to the public without proper characterization.

   Response: All materials from radiological facilities are properly characterized, surveyed, evaluated, and approved for shipment to disposal or recycling facilities. All of these activities are performed under regulatory oversight. Follow-up surveys that were conducted of nonradiological office buildings have not indicated any contamination above the limits established by state and federal regulations.

6. **Comment on SSFL Cleanup Responsibilities:** Why is DOE only evaluating the ETEC site? DOE should evaluate the entire SSFL site for radiological contamination and hazardous material contamination. What area of SSFL is DOE responsible for, and what is being covered in the ETEC EA? Who is responsible for NEPA determination for the SSFL?

   Response: DOE is responsible only for DOE-owned facilities and DOE-funded operations at SSFL. Therefore, this EA only covers activities at ETEC and contamination releases from DOE operations at ETEC that may extend beyond its boundaries. The SSFL site is the responsibility of NASA, the Department of Defense, and the Boeing Company, which are responsible for management and funding of activities for their respective areas of the SSFL. The State of California will conduct an assessment and prepare an environmental impact report under the California Environmental Quality Act for the chemical contamination at SSFL, including the ETEC site. The DOE is only responsible for NEPA determination of ETEC.

7. **Comment on Alternatives:** DOE should evaluate several alternatives as part of the EA. Issues such as contamination in the bedrock and groundwater contamination should be evaluated.

   Response: This EA evaluates an alternative that would reduce the additional lifetime cancer risk to the maximally exposed individual residing on the ETEC site to 1×10^{-6}. This would involve removing substantial amounts of soil, in some cases down to bedrock. Groundwater contamination is being evaluated under RCRA.

8. **Comment on Notification:** How are people being notified of these meetings?

   Response: Over 1,600 mailings were sent out informing state and federal agencies and the public of the scoping meetings. Additionally, the meetings were announced in public media.

9. **Comment on Models and Assumptions:** Assumptions used for input into models should be as conservative as possible.

   Response: All risk models and input parameters are subject to review by regulatory agencies. Results are generally considered to be very conservative. Assumptions used for environmental effect analyses follow state and federal laws and regulations. Parameters used in risk models that are known, including contamination concentrations, are input as accurately as possible, with a bias toward being conservative. Parameters that cannot be accurately determined are estimated based on known information and regulatory guidance. The model input parameters are often selected to represent conservative values (i.e., likely to overestimate risk). However, sometimes a parameter value selected to address an uncertainty may not be conservative.

10. **Comment on Access Control:** Access to the site should be controlled so the public cannot be exposed to any remaining contamination.

    Response: Access to the site is currently being controlled by Rocketdyne.DOE cannot determine the long-term use of the site. Rocketdyne has no plans to release the site for public use anytime in the near future and will maintain control of the site.

11. **Comment on Sodium Reactor Experiment Meltdown Building:** What is the status of the building that housed a reactor meltdown in 1959?

    Response: All radioactive material was removed in the 1960s and 1970s. The facility was decommissioned and decontaminated in the late 1970s and early 1980s. It was released for unrestricted use in 1985. The building was torn down in 1999.

12. **Comment on Soil Contamination:** What is the status of the hazardous and radioactive soil contamination, how is it being shipped, and where is it being shipped?

    Response: Information on radioactive soil contamination is addressed in Chapters 2 through 4 of this EA. Hazardous soil contamination is being addressed under RCRA.

13. **Comment on Sodium Burn Pit:** The status of the remediation of the sodium burn pit is not clear. There should be a discussion of the sodium burn pit in the EA.

    Response: The Former Sodium Disposal Facility (FSDF) originally consisted of a rectangular, concrete-lined pit filled with water, two water-filled basins, and a small building (4886). The facility began operations in the 1950s and ceased operations in 1977. During operations, various components were opened to expose sodium and a sodium potassium alloy, washed with water, and often placed in the ponds to ensure complete reaction (burning) of the sodium. The items were then retrieved and disposed of offsite. Some components containing radioactive material were inadvertently placed in the FSDF. In 1992, the California Department of Toxic Substances Control and the California Regional Water Quality Control Board approved the FSDF Closure Plan, and DOE issued a categorical exclusion under NEPA for cleanup of the facility. In July 1992, soil excavation was initiated. All radiological and sodium components and all radioactive soil were removed by 1995 and the California Department of Health Services issued a release for unrestricted use with respect to radiological contamination in May 1998. The site is designated as a Solid Waste Management Unit under RCRA, and final verification that no chemical contamination poses a risk to human health or the environment will be addressed in the RCRA corrective action process, independently from the decisions made based on this EA. The Department of Toxic Substances Control is also preparing an Environmental Impact Report that addresses chemical contamination at all of SSFL.

14. **Comment on Evaluating Past Actions:** Why are past cleanup activities not being addressed in this EA?

    Response: Past cleanup activities are not addressed in the EA because those activities are complete and are not the subject of DOE decisionmaking. Alternative 2 does address the additional soil remediation that would be required to meet the 1×10^{-6} cleanup standard.

15. **Comment on Fire Accident Scenario:** DOE should evaluate a brush fire and the potential for release of hazardous and radioactive materials due to such a fire.

    Response: The potential impacts of a brush fire at ETEC are addressed in Chapter 4 of this EA.

16. **Comments from the EPA:**

    a. "**Cleanup Levels:** We suggest DOE use this EA process as an opportunity to ask for public comment regarding soil and water cleanup levels and to explain to the public the process that will be used to select the cleanup levels. This would ideally involve an open process that is similar to the process used to select chemical cleanup levels under RCRA; i.e., EPA and DOE ask for public comment, hold a public meeting to explain the proposed levels and obtain comments, and then respond to the comments and select the remedy (including cleanup levels)."

    b. "**Site Characterization:** The EA is currently limited to the 90 acres of ETEC. There are several other areas that should be included in the assessment: 1) Leach Fields attached to former nuclear facilities, 2) Areas (if any) that have not been formally released if decontamination and decommissioning have already occurred."

    c. "**Unknown Areas of Contamination:** In the event that DOE suspects a building or area (beyond the 3 identified in the EA) that may be contaminated, we would like the EA to address the mechanism by which DOE will notify the regulatory agencies and the public. Further, if an area is discovered to actually be contaminated, we would like the EA to address how DOE will involve the regulatory agencies and the community in its decision-making process."

    d. "**Remedy Costs:** We expect DOE to share remedy cost figures with the community as part of the alternatives analysis portion of the remedy selection process. Overall figures should be presented as part of the decision-making process. DOE's waste minimization policy should be included as an attachment or appendix to the EA as it would help the public understand the constraints, parameters, and guidance that DOE is operating under. Similarly, any other relevant cleanup policies or orders (such as DOE Order 5400.5 and the moratorium on recycling metal from radioactive buildings) should also be included. Finally, DOE should include a wide range of options in its analysis of alternatives. For example, would it be cheaper to dispose of a large portion of radioactive buildings as radioactive waste rather than surveying, sampling, decontaminating, and repeating?"

Responses:

a. **Cleanup Levels:** This EA process did ask for public comment regarding cleanup levels and explains the process that will be used to select cleanup levels as requested. In fact, DOE analyzed the 1×10^{-6} additional lifetime cancer risk standard at the request of stakeholders. The opportunities and schedule for public input are provided in Section 1.4.

b. **Site Characterization:** Leach fields are identified as areas of concern and are addressed under the RCRA process. Leach fields are being sampled for chemical contamination under Department of Toxic Substances Control oversight and radiological contamination under Department of Health Services oversight. Past cleanup activities are not addressed in the EA because those activities are complete and are not the subject of DOE decisionmaking. Alternative 2 does address the additional soil remediation that would be required to meet the 1×10^{-6} cleanup standard.

c. **Unknown Areas of Contamination:** Continued sampling could detect new areas of radioactive or chemical contamination associated with DOE activities in Area IV. If so, these will be incorporated into the ongoing remediation process. If additional radiological contamination is found at levels substantially beyond that analyzed in the EA, the document would be modified with appropriate opportunity for public involvement.

d. **Remedy Costs:** Cost data is not provided because DOE believes that the EA should focus on potential environmental impacts rather than cost or technical issues. Rocketdyne's waste minimization policy is detailed in the *ETEC Waste Minimization and Pollution Prevention Awareness Plan*, available from DOE Oakland. This plan complies with DOE Order 5400.1, General Environmental Protection Program, and is available on the Internet (http://www.directives.doe.gov/pdfs/doe/doetext/oldord/5400/o54001c1.html). The specific alternative of disposing of large portions of radioactive buildings as radioactive waste was considered but not analyzed in detail, as discussed in Chapter 3.

APPENDIX B. LIST OF AGENCIES AND PERSONS CONSULTED AND CONTACTED

AGENCIES AND PERSONS CONSULTED

U.S. Environmental Protection Agency

- Larry Bowerman

California Department of Health Services

- Steve Hsu
- Roger Lupo

California Department of Toxic Substances Control

- Pauline Batarseh
- Gerard Abrams
- Eric Maher

U.S. Fish and Wildlife Service

- Rick Farris

AGENCIES AND PERSONS CONTACTED

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
THE HONORABLE	BARBARA BOXER		U.S. SENATE	LOS ANGELES
THE HONORABLE	DIANNE FEINSTEIN		U.S. SENATE	LOS ANGELES
THE HONORABLE	A BEILENSON		U S HOUSE OF REP.ATTN MS SUSAN LITTLE	WOODLAND HILLS
THE HONORABLE	ELTON GALLEGLY		U S HOUSE OF REP. ATTN MR BRIAN MILLER	OXNARD
THE HONORABLE	HOWARD BERMAN		U S HOUSE OF REP. ATTN MS ROSE CASTENADA	MISSION HILLS
THE HONORABLE	HENRY WAXMAN		U S HOUSE OF REP.ATTN NOELLE BRENNAN	LOS ANGELES
THE HONORABLE	PAULA BOLAND		CALIFORNIA STATE ASSEMBLY MR SCOTT WILK	GRANADA HILLS
THE HONORABLE	CATHIE WRIGHT		CA STATE SENATE ATTN JAN SMITH	SIMI VALLEY
THE HONORABLE	RICHARD RIORDAN		CITY OF LOS ANGELES	LOS ANGELES
THE HONORABLE	GREG STRATTON		MAYOR CITY OF SIMI VLY ATTN LAURA HERRON	SIMI VALLEY
		SIMI VALLEY CITY HALL	ATTN MR MARK OYLER	SIMI VALLEY
		SIMI VALLEY CITY HALL	MR MIKE SEDELL CITY MANAGER ATTN D HARRIS	SIMI VALLEY
		CITY OF MOORPARK	STEVE KUENY CITY MANAGER	MOORPARK
		HIDDEN HILLS CITY HALL	CHERIE PAGLIA CITY MANAGER	HIDDEN HILLS
THE HONORABLE	LAURA CHICK		L.A. CITY COUNCIL 3RD DISTR MS DENISE SCHALL	RESEDA
THE HONORABLE	HILDA L SOLIS		STATE SENATOR	EL MONTE

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
THE HONORABLE	HAL BERNSON		LA CITY COUNCIL 12TH DIST ATTN LEE HINTLIAN	LOS ANGELES
THE HONORABLE	Z YAROSLAVSKY		3RD SUPERVISIONAL DISTR MS LAURA FAY	CALABASAS
THE HONORABLE	GLORIA MOLINA		SUPERVISOR COUNTY OF LOS ANGELES	LOS ANGELES
		DEPT OF WATER AND POWER	ATTN MEL BLEVINS RM 1455	LOS ANGELES
THE HONORABLE	M ANTONOVICH		L A BOARD OF SUPERVISORS LETTA PISTONE	CHATSWORTH
THE HONORABLE	JUDY MIKELS		BOARD OF SUPERVISORS 4TH DIST JASON OLIVER	SIMI VALLEY
THE HONORABLE	FRANK SCHILLO		VTA BOARD SUPERVISORS 2ND DIST RON STARK	THOUSAND OAKS
		LOS ANGELES COUNTY FIRE DEPT	HEALTH HAZARDOUS MTRL DIV TOM KLINGER	LOS ANGELES
		VENTURA CO RESOURCE MGMT AGENCY	ENVIRONMENTAL HEALTH DIV DOUG BEACH	VENTURA
		VENTURA COUNTY RESOURCE MGMT AGENCY	ENVIRONMENTAL HEALTH DIV STEVE KEPHART	VENTURA
		COUNTY OF VENTURA	WATER WORKS DIST 17 ATTN REDDY PAKALA	MOORPARK
		COUNTY OF VENTURA WATERWORKS	ATTN ANNE DANA	MOORPARK
		COUNTY OF VENTURA	AIR POLLUTION CONTROL RICHARD BALDWIN	VENTURA
		DEPARTMENT OF TRANSPORTATION	ATTN WILFORD MELTON	LOS ANGELES
		CA WATER RESOURCES CONTROL BOARD	ATTN MS KAREN BESSETTE	SACRAMENTO
	ANGELA SCHROETER	ST WATER RESOURCES CNTRL BRD	CLEAN WATER PROGRAM	SACRAMENTO
	ROBERT HARTLEY	VENTURA COUNTY ENV HEALTH DIVISION		VENTURA
DR	ROBERT HARRISON	CA DEPT OF HEALTH SERVICES	OCC HEALTH PRGM	OAKLAND
MS	LEE LOCKIE	SCAQMD	DIRECTOR MAJOR SOURCE/RECLAIM	DIAMOND BAR
		US EPA - REGION IX	OFFICE OF SUPERFUND PROGRAMS J CLIFFORD	SAN FRANCISCO
		NASA/HQ/NXG	ATTN MIKE GREEN	WASHINGTON
		ALA SPACE & ROCKET CTR	ATTN REBECCA MCCALEB (AB10)	HUNTSVILLE
		NASA/HQ/NXG	ATTN ARTHUR R LEE	WASHINGTON
		US EPA - LAS VEGAS FACILITY	RADIATION PROGRAMS GREGG DEMPSEY	LAS VEGAS
		BRANDEIS-BARDIN INSTITUTE	ATTN MR ARTHUR PINCHEV	SIMI VALLEY
		CA DEPT OF HEALTH SERVICES	ENVIRONMENTAL MANAGEMENT K S WONG	LOS ANGELES
MR	DAN HIRSCH		COMMITTEE TO BRIDGE THE GAP	LOS ANGELES
	JEROME RASKIN			NORTHRIDGE
MR	SHELDON PLOTKIN		SO CALIFORNIA FEDERATION OF SCIENTISTS	LOS ANGELES
MS	BARBARA JOHNSON			SIMI VALLEY
		ROCKETDYNE OCCUPATIONAL HEALTH STUDY	DEPT OF EPIDEMIOLOGY DR H MORGENSTERN	LOS ANGELES
		SANTA MONICA MOUNTAINS	REC & CONSER AUTHORITY ATTN RORIE SKEI	MALIBU
		CANOGA PARK/WEST HILLS CHAMBER OF COMMER	ATTN ALINE HAUSMAN EXECUTIVE DIRECTOR	CANOGA PARK
		BELL CANYON ASSOCIATION	ATTN MS CAROL HENDERSON	CANOGA PARK
		SUSANA KNOLLS HOMEOWNERS	ATTN CARI CARUSO	SIMI VALLEY
		SAN FERNANDO VLY ASSOC OF REALTORS	MILLIE JONES PUBLIC AFFAIRS DIRECTOR	VAN NUYS
		GROUNDWATER RESOURCES CONSULTANTS	ATTN MS DINAH JASENSKY	TUCSON
		LAKE TIMES	C/O TODD C OLSEN ATTN BOB WOOD	NORTHRIDGE

TITLE	NAME	FIRM	ATTN	CITY (CA unless otherwise noted)
		CSUN	URBAN ARCHIVES CTR R MARSHALL RM 4	NORTHRIDGE
		OAK PARK UNIFIED SCH DIST	ATTN MR STAN MANTOOTH	OAK PARK
		DR NAOMI BISHOP PROFESSOR AND CHAIR	CSUN DEPARTMENT OF ANTHROPOLOGY	NORTHRIDGE
		LAUSD ENVIRONMENT	HEALTH & SAFETY ATTN EVAN ROSE	LOS ANGELES
		L A UNIFIED SCHOOLS	ENVIRONMENTAL HEALTH & SAFETY P VAISANEN	LOS ANGELES
		SIERRA CLUB	ATTN MS LIZ ALLEN	CLAREMONT
		ENVIRONMENTAL DEFENSE FUND	ROCKRIDGE MARKET MALL ATTN DAVID ROE	OAKLAND
		CITIZENS CLEARINGHOUSE HAZARDOUS WASTE	ATTN MS ANNA MARIE STENBERG	FORT BRAGG
		LEAGUE OF WOMEN VOTERS	ATTN MS ANNE COOMBES	LOS ALTOS HILLS
		CITIZENS FOR A BETTER ENVIRONMENT	ATTN CARLOS PORRAS	LOS ANGELES
		CLEAN WATER ACTION	ATTN MR BRUCE LIVINGSTON	SAN FRANCISCO
		FRIENDS OF LOS ANGELES RIVER		LOS ANGELES
		PLANNING AND CONSERVATION LEAGUE	ATTN MR GARY A PATTON	SACRAMENTO
		ENVIRONMENTAL HEALTH COALITION	ATTN MS DIANE TAKVORIAN	SAN DIEGO
		CALIFORNIA PUBLIC INTEREST RESEARCH	MS MARY RAFTERY LEGISLATIVE ADVOCATE	SACRAMENTO
		CA COUNCIL FOR ENVIRONMENTAL &	ECONOMIC BALANCE VICTOR WEISSER	SAN FRANCISCO
		LABOR/COMMUNITY STRATEGY CENTER		LOS ANGELES
		WASTE MANAGEMENT OF NO AMERICA	GOVERNMENT AFFAIRS ATTN CHUCK WHITE	SACRAMENTO
		MOTHERS OF EAST LOS ANGELES	ATTN JUANA GUITERREZ	LOS ANGELES
		CONCERNED CITIZENS OF SOUTH CENTRAL	ATTN JUANITA TATE	LOS ANGELES
	CHARLES CATE	CITY OF CALABASAS		CALABASAS
	JIM CHADA		OAK LAKE ASSOCIATION	WEST HILLS
	WILLIAM S HAYNES			CHATSWORTH
	LINDA HAYS		UNITED AUTO WORKERS LOCAL 1519	SAUGUS
	MICHAEL W KUHN		CITY OF SIMI VALLEY ENVIRONMENTAL SER	SIMI VALLEY
	STEPHEN LENSKE		PRESIDENT VLY WEST HILLS OWNER ASSOC	WEST HILLS
DR	MELANIE BECK		SANTA MONICA MOUNTAINS NTL REC AREA	THOUSAND OAKS
	STEVE MOGIL	WEST HILLS NEIGHBORHOOD ASSOC.		WEST HILLS
	SUMMER NICHOLSON		CHATSWORTH CONSERVATION COALITION	CHATSWORTH
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		PEOPLE OF REASON IN SCIECE & MED		ANAHEIM
		SAN DIEGO BAY KEEPER	MR DELANO	SAN DIEGO
THE HONORABLE	SHEILA KUEHL		LAURA PLOTKIN 41ST ASSEMBLY DISTRICT	ENCINO
THE HONORABLE	TOM MCCLINTOCK		ATTN MICHELLE LUSE	GRANADA HILLS

APPENDIX C. RADIATION AND HUMAN HEALTH

WHAT IS RADIATION?

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. We are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ultraviolet radiation (which causes sunburn), X-rays, and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace electrons from atoms or molecules to create ions. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, alpha and beta radiation). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called radioactive decay, is the transformation of an unstable atom (a radionuclide) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—alpha particles, beta particles, and gamma or X-rays—but our senses cannot detect them. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding for beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. In fact, some gamma radiation will pass through the body without interacting with it.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials (materials or substances that contain radionuclides), such as radioactive waste or radionuclides in soil. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once a radioactive material is in the body, its fate is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

RADIATION DOSE

Exposure to ionizing radiation is expressed in terms of absorbed dose, which is the amount of energy imparted to matter per unit mass. Often simply called dose, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the *rad*.

The different types of radiation mentioned above have different effects in damaging the cells of biological systems. Dose equivalent is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the rem.

In quantifying the effects of radiation on humans, other concepts are also used. The concept of effective dose equivalent is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to cancer. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long half-lives and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is also the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of dose presented in this EA, unless specifically noted as something else, are total effective dose equivalents, which are quantified in terms of rem or millirem (which is one one-thousandth of a rem).

More detailed information on the concepts of radiation dose and dose equivalent are presented in publications of the National Council on Radiation Protection and Measurements (NCRP 1993) and the International Commission on Radiological Protection (ICRP 1991).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) to dose are called dose conversion factors. The International Commission on Radiological Protection and federal agencies such as EPA publish these factors (Eckerman and Ryman 1993; Eckerman et al. 1988). They are based on original recommendations of the International Commission on Radiological Protection (ICRP 1977).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a dose rate, which is dose per unit time (usually an hour or a year). Collective dose is the total dose to an exposed population. Person-rem is the unit of collective dose. Collective dose is calculated by multiplying the individual dose by the number of individuals in a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period of time, typically 24 hours or less. Chronic exposures occur over longer times (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

On average, members of the public nationwide are exposed to approximately 300 millirem per year from natural sources (NCRP 1987). The largest natural sources are radon-222 and its radioactive decay products in homes and buildings, which contribute about 200 millirem per year. Additional natural sources include radioactive material in the Earth (primarily the uranium and thorium decay series, and potassium-40) and cosmic rays from space filtered through the atmosphere. With respect to exposures resulting from human activities, the combined doses from weapons testing fallout, consumer and industrial products, and air travel (cosmic radiation) account for the remaining approximate 3 percent of the total annual dose. Nuclear fuel cycle facilities contribute less than 0.1 percent (0.05 mrem per year) of the total dose.

POTENTIAL TO INCUR CANCER

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. When radiation interacts with tissue, it deposits a small amount of energy. The deposited energy – the dose – causes the molecules of tissue to undergo transformations. These transformations, in turn, create changes in cell function. If the dose is very high, these changes disrupt the function of the cells, tissues, and organism to such an extent that severe illness ("acute radiation syndrome") is induced. At low doses, these changes generally do not create significant effects in the cells and tissues as the body has a number of corrective defense systems that remove the damage or eliminate the damaged cell. Nevertheless, the possibility exists that these induced changes could escape the protective functions and result in the induction of cancer.

This EA expresses radiological health impacts as the incremental changes in the number of expected fatal cancers (latent cancer fatalities) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health effect conversion factors recommended by the International Commission on Radiological Protection (ICRP 1991). The Commission estimated that, for the general population, a collective dose of 1 person-rem will yield 0.0005 excess latent cancer fatality. For radiation workers, a collective dose of 1 person-rem will yield an estimated 0.0004 excess latent cancer fatality. The higher risk factor for the general population is primarily due to the inclusion of children in the population group, while the radiation worker population includes only people older than 18.

For example, a population would have to be exposed to a radiation dose of 2,000 person-rem for there to be 1 excess latent cancer fatality:

$$0.0005 \text{ latent cancer fatalities/rem} \times 2{,}000 \text{ person-rem} \approx 1 \text{ latent cancer fatality}$$

If a member of the public were exposed to a radiation dose of 15 millirem per year for 30 years, the lifetime probability of a latent cancer fatality would be about 0.0003:

$$0.0005 \text{ latent cancer fatalities/rem} \times 15 \text{ millirem/year} \times 30 \text{ years} \times 1 \text{ rem/1000 millirem} \approx 0.0003 \text{ latent cancer fatality}$$

Other health effects such as nonfatal cancers and genetic effects can occur as a result of chronic exposure to radiation. Inclusion of the incidence of nonfatal cancers and severe genetic effects from radiation exposure increases the total detriment by 40 to 50 percent (Table C-1), compared to the change for latent cancer fatalities (ICRP 1991). As is the general practice for any DOE EA, estimates of the nonfatal cancers and severe genetic effects were not included in this EA.

Table C-1. Risk of Latent Cancer Fatalities and Other Health Effects from Exposure to Radiation

Population	Latent Cancer Fatality	Nonfatal Cancer	Genetic Effects	Total Detriment
Workers	0.0004	0.00008	0.00008	0.00056
General Population	0.0005	0.00010	0.00013	0.00073

Source: ICRP (1991)

Exposures to high levels of radiation at high dose rates over a short period (less than 24 hours) can result in acute radiation effects. Minor changes in blood characteristics might be noted at doses in the range of 25 to 50 rad. The external symptoms of radiation sickness begin to appear following acute exposures of about 50 to 100 rad and can include anorexia, nausea, and vomiting. More severe symptoms occur at higher doses and can include death at doses higher than 200 to 300 rad of total body irradiation, depending on the level of medical treatment received. Information on the effects of acute exposures on humans was obtained from studies of the survivors of the Hiroshima and Nagasaki bombings and from studies following a multitude of acute accidental exposures. Factors to relate the level of acute exposure to health effects exist but are not applied in this EA because expected exposures during normal operations and accidents would be well below 50 rem.

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APPENDIX D. SENSITIVE SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Tables D-1 through D-5 are excerpted from the April 1998 *Biological Conditions Report, Santa Susana Field Laboratory* (Ogden 1998), and updated in 2000 with information from the *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California* (Ogden 2000, Appendix C).

Table D-1. Sensitive Plant Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Santa Susana tarplant *(Hemizonia minthornii)*	Rare	--	Observed throughout the SSFL, primarily on rock outcrops.
Southern California black walnut *(Juglans californica* var. *californica)*	Candidate (CNPS List 4)	--	Observed throughout the SSFL.
Braunton's milkvetch *(Astragalus brauntonii)*	Candidate (CNPS List 1B)	Endangered	Observed in Area IV.
Plummer's mariposa lily *(Calochortus plummerae)*	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in chaparral habitat onsite. Less common at higher elevations. Has been reported in area of the SSFL but not on or immediately adjacent to the SSFL.
San Fernando Valley spineflower *(Chorizanthe parryi* var. *fernandina)*	Candidate (CNPS List 1A)	Candidate	Not observed. Extremely low potential to occur at SSFL.
Santa Monica Mountains dudleya *(Dudleya cymosa* ssp. *ovatifolia)*	Candidate (CNPS List 1B)	Threatened	Not observed. Low potential to occur onsite. Known from fewer than 10 occurrences, none of which are at or adjacent to the SSFL.
Lyon's pentachaeta *(Pentachaeta lyonii)*		Endangered	Not observed. May occur onsite. Additional surveys planned.
California orcutt grass *(Orcuttia californica)*		Endangered	Not observed. May occur onsite. Additional surveys planned.
Many-stemmed dudleya *(Dudleya multicaulis)*	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in the coastal sage scrub and chaparral habitats onsite. Not reported to occur at or adjacent to the SSFL.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

CNPS = California Native Plant Society
SSFL = Santa Susana Field Laboratory

Table D-2. Sensitive Reptile Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
San Diego horned lizard *(Phrynosoma coronatum blainvillei)*	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat at the SSFL. Known to occur within the Santa Susana Mountains.
Silvery legless lizard *(Anniella pulchra pulchra)*	Species of Special Concern	--	Not observed. Moderate potential to occur in appropriate habitat (chaparral and coastal scrub) at the SSFL.
Coastal rosy boa *(Lichanura trivirgata roseofusca)*	Protected	--	Not observed. High potential to occur in appropriate habitat (rocky chaparral-covered hillsides and canyons) at the SSFL.
Coast patch-nosed snake *(Salvadora hexalepis virgultea)*	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat (coastal chaparral) at the SSFL. Widely distributed throughout California.
Two-striped garter snake *(Thamnophis hammondi)*	Special Animal	--	Expected to occur throughout appropriate habitat at the SSFL.
Southern rubber boa *(Charina bottae umbratica)*	Species of Special Concern		Could potentially occur at SSFL.
Southern Pacific rattlesnake *(Crotalis viridis helleri)*	Species of Special Concern		Could potentially occur at SSFL.
San Diego mountain king snake *(Lampropeltis zonata pulchra)*	Protected	--	Not observed. Low to moderate potential to occur in the rock outcrop habitat at the SSFL. May be at edge of range.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

Table D-3. Sensitive Aquatic, Amphibian, and Insect Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
San Diego fairy shrimp *(Branchinecta sandiegoensis)*		Endangered	Could potentially occur at SSFL.
Western spadefoot toad *(Scaphiopus hammondi)*	Species of Special Concern	--	Not observed. Low to moderate potential to occur at the SSFL. Occurs primarily in native grasslands at lower elevations. Few small patches of native grassland occur at the SSFL and may not be sufficient to support toad populations.
Southwestern pond turtle *(Clemmys marmorata pallida)*	Species of Special Concern (under review for protected status)	--	Not observed. Low to moderate potential to occur in the aquatic habitat at the SSFL.
Arroyo southwestern toad *(Bufo microscaphus californicus)*		Endangered	Could potentially occur at SSFL.
California red-legged frog *(Rana aurora draytoni)*	Species of Special Concern	Threatened	Not observed. Low potential to occur in the aquatic habitat at the SSFL. Uncommon throughout southern California.
Quino checkerspot butterfly *(Euphydryas editha quino)*		Endangered	Could potentially occur at SSFL.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

Table D-4. Sensitive Bird Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Double-crested cormorant *(Phalacrocorax auritus)*	Species of Special Concern	--	Observed on Silvernale Reservoir. There is only a low to moderate probability that this species nests onsite.
Great blue heron *(Ardea herodias herodias)*	Special Animal	--	Observed in freshwater marsh and aquatic habitat at the Silvernale Reservoir. Moderate potential to nest in the large trees at SSFL.and at the Building 56 Landfill.
California gnatcatcher *(Polioptila californica)*	Species of Special Concern	Threatened	Not observed. Low potential to occur in the sage scrub habitat onsite. May be at edge of known range. Focused surveys did not detect gnatcatchers.
Southern California rufous-crowned sparrow *(Aimophila ruficeps canescens)*	Species of Special Concern	--	Observed near of Area IV.
Loggerhead shrike *(Lanius ludovicianus)*	Species of Special Concern	--	Observed near Area IV. This species probably nests at SSFL.
Least Bell's vireo *(Vireo belii pusillus)*		Endangered	Could potentially occur at SSFL.
Southwestern willow flycatcher *Empidonax trailii extimus*		Endangered	Could potentially occur at SSFL.
Sharp-skinned hawk *(Accipiter striatus velox)*	Species of Special Concern	--	Observed flying over the SSFL. Historically documented at SSFL by Rocketdyne personnel.
Red-shouldered hawk *(Buteo lineatus elegans)*[b]	--	--	Observed evidence of nesting in Area IV.
Red-tailed hawk *(Buteo jamaicencis)*[b]	--	--	Observed roosting in the vicinity of Area IV, and flying over the Building 56 Landfill.
Turkey vulture *(Cathartes aura)*[b]	--	--	Observed roosting and flying over the entire SSFL; expected to forage on the property.
Great horned owl *(Bubo virginianus)*[b]	--	--	Observed two owls roosting in the vicinity of Area IV.
Cooper's hawk *(Accipiter cooperii)*	Species of Special Concern	--	Observed a male and female roosting in the vicinity of Area IV. This species has a high probability of nesting onsite.
Golden eagle *(Aquila chrysaetos canadensis)*	Species of Special Concern	Protected	Not observed during biological surveys; however, this species has been historically documented by Rocketdyne personnel.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.
b. Although no official status is given for these raptors, raptor nests are protected to varying degrees by separate state regulations. Additionally, raptors are considered important to the ecosystem due to their position at the top of the food chain.

SSFL = Santa Susana Field Laboratory

Table D-5. Sensitive Mammal Species

Species Name	State Status	Federal Status	Likelihood of Occurrence[a]
Bobcat *(Felis rufus)*	Harvest Species	--	Observed throughout the SSFL.
Mule deer *(Odocoileus hemionus)*	Harvest Species	--	Observed throughout the SFL.
San Diego black-tailed jackrabbit *(Lepus californica bennettii)*	Species of Special Concern	--	Observed in Area IV.
Los Angeles little pocket mouse *(Perognathus longimembris brevinasus)*	Species of Special Concern	Under review for endangered or threatened status	Not observed. Low to moderate potential to occur in appropriate habitat at SSFL. A live-trapping study would need to be performed to determine if this subspecies is present at SSFL.
Ringtail *(Bassariscus astutus)*	Protected	--	Moderate to high potential to occur at SSFL in areas of rock outcrops.
Mountain lion *(Felis concolor)*	Harvest Species	--	Not observed. High potential to occur at SSFL. Known to occur in the area.
American badger *(Taxidea taxus jeffersoni)*	Species of Special Concern, Harvest Species	--	Not observed. High potential to occur at SSFL. Known to occur in the area.
San Diego desert woodrat *(Neotoma lepida intermedia)*	Species of Special Concern	--	Not observed during biological surveys; however, this species has been historically documented by SSFL personnel.

a. Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

SSFL = Santa Susana Field Laboratory

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